JUNE 1936

MECCANO MAGAZINE

PRICE 6D
VOL. XXI
No 6

SWISS MOUNTAIN RAILWAYS
(See Page 316)

MECCANO

ENGINEERING FOR BOYS

The Best Hobby in the World for Boys

Every boy is happiest when he is inventing, creating and building. That is the reason for the everlasting popularity of Meccano. It is the most wonderful and the most fascinating hobby in the world, because it enables full scope to be given to all the inclinations and desires that are the natural heritage of boys.

There is no limit to the number of models that can be built with Meccano—Cranes, Clocks, Motor Cars, Ship-Coalers, Machine Tools, Locomotives—in fact everything that interests boys. The most wonderful thing about Meccano is that it is REAL ENGINEERING; yet it is so simple that any boy can join in the delightful fun and excitement of model-building without having to learn anything. A beautifully illustrated Book of Instructions and a screwdriver and a spanner—the only tools required—are included with every Outfit.

Make friends with your dealer—he can help you.

Prices of Meccano Outfits

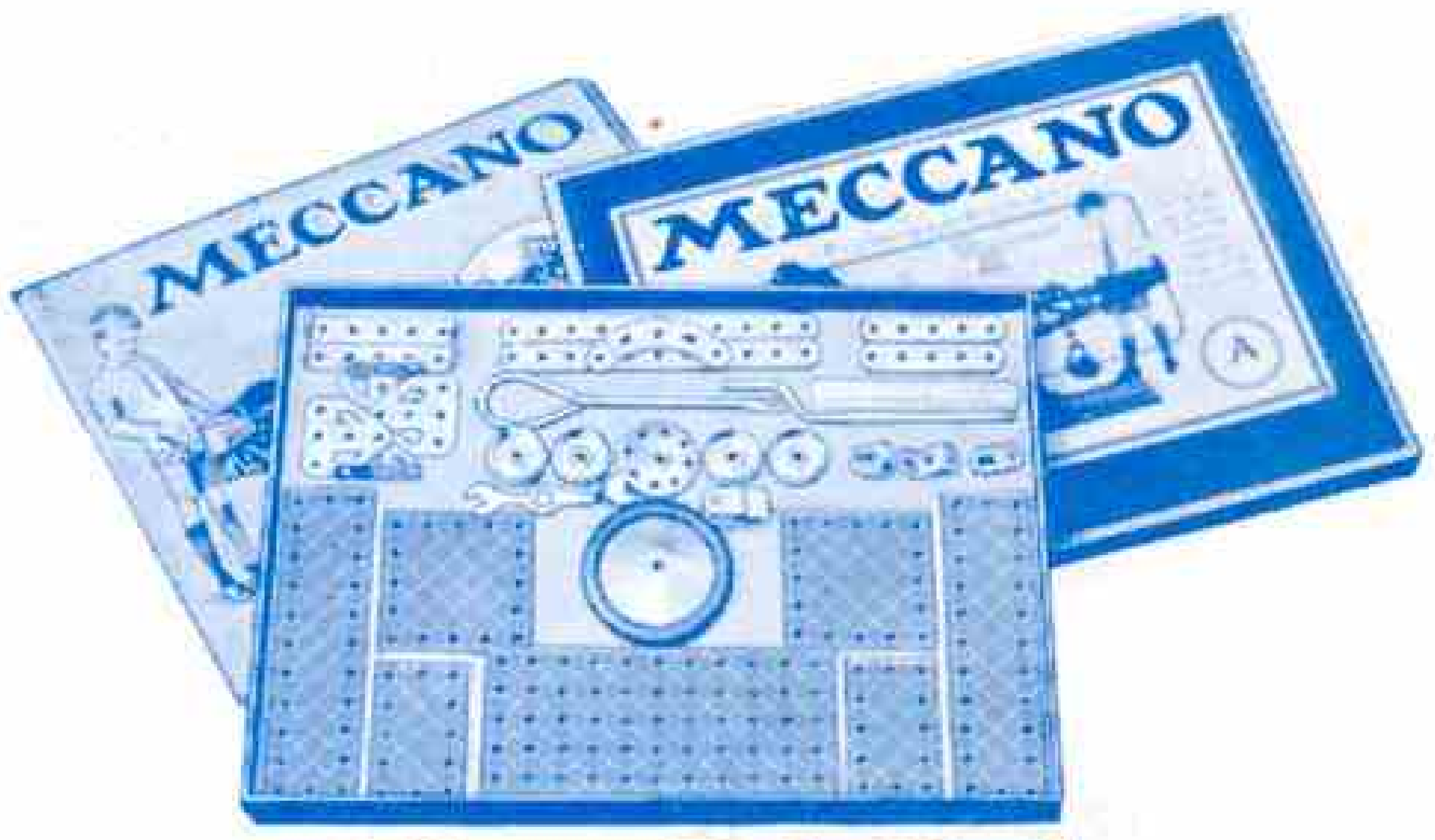
COMPLETE OUTFITS

A Outfit		each	5/-
B ..		..	7/6
C ..		..	10/-
D ..		..	15/-
E ..		..	20/-
F ..		..	30/-
G ..		..	55/-
H ..	(Carton)	..	72/6
Hw ..	(Cabinet)	..	97/6
K ..	(Carton)	..	132/6
Kw ..	(Cabinet)	..	157/6
L ..	(..)	..	400/-

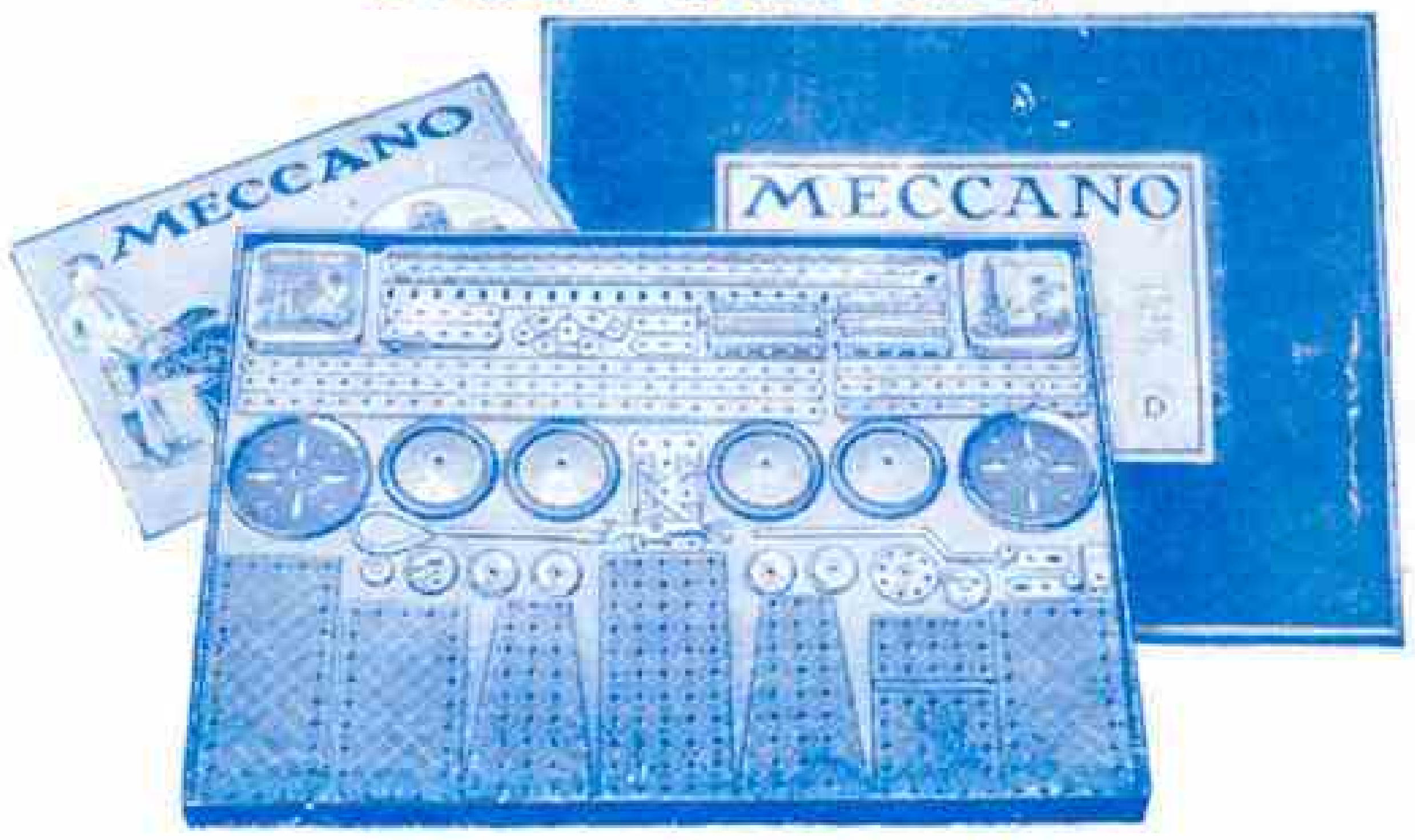
ACCESSORY OUTFITS

Aa	converts	A	Outfit	into	B	each	2/6
Ba	..	B	..	..	C	..	3/-
Ca	..	C	..	..	D	..	5/6
Da	..	D	..	..	E	..	5/6
Ea	..	E	..	..	F	..	11/-
Fa	..	F	..	..	G	..	26/6
Ga	..	G	..	..	H	..	17/6
Ha	..	H	..	..	K	..	60/-
Ka	..	K	..	..	L	..	225/-

Meccano Limited, Binns Road, Liverpool 13

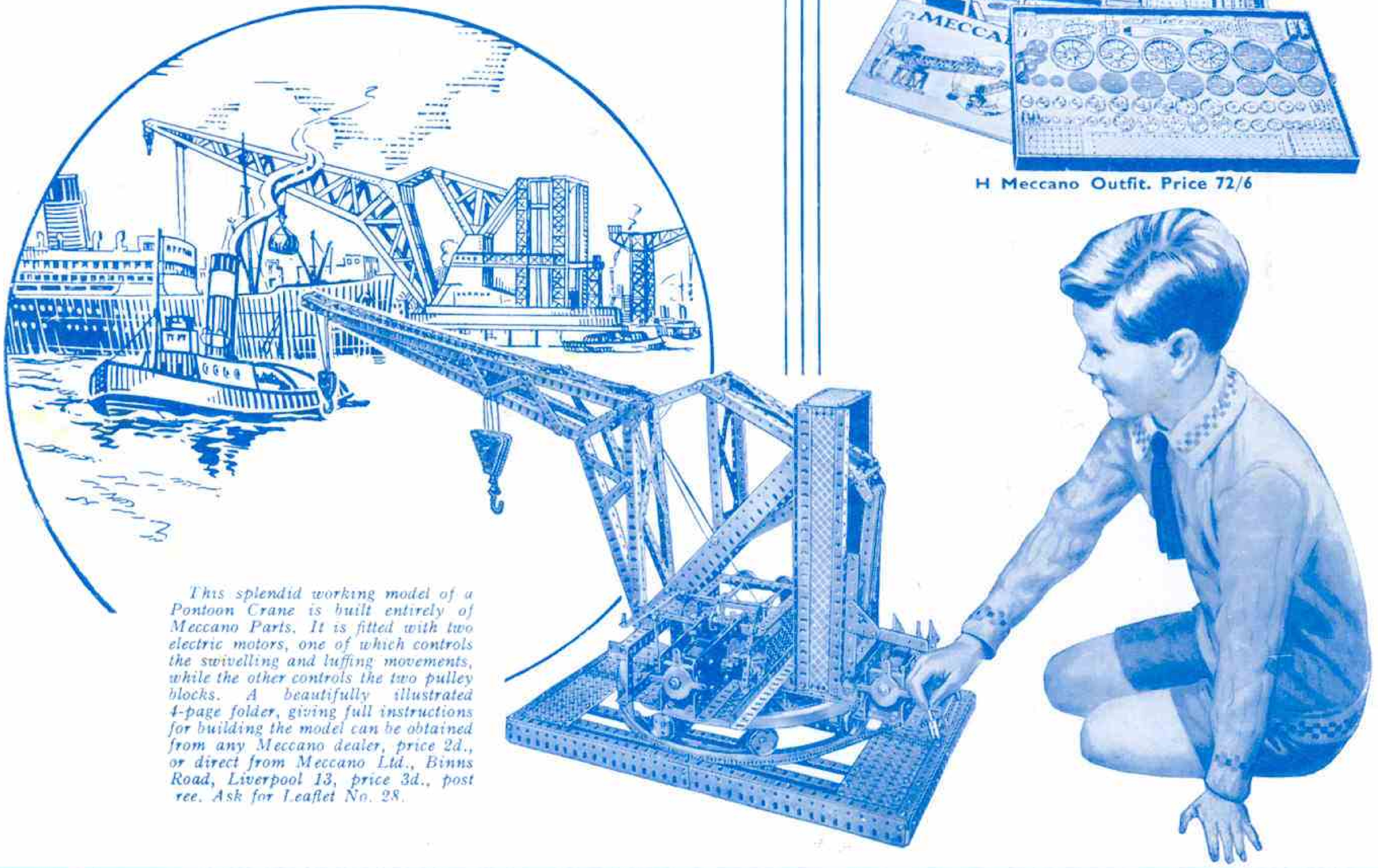


A Meccano Outfit. Price 5/-



D Meccano Outfit. Price 15/-

H Meccano Outfit. Price 72/6



This splendid working model of a Pontoon Crane is built entirely of Meccano Parts. It is fitted with two electric motors, one of which controls the swivelling and luffing movements, while the other controls the two pulley blocks. A beautifully illustrated 4-page folder, giving full instructions for building the model can be obtained from any Meccano dealer, price 2d., or direct from Meccano Ltd., Binns Road, Liverpool 13, price 3d., post free. Ask for Leaflet No. 28.

EXTRA SPECIAL EDITION

EXHIBITION OF NAVAL EQUIPMENT

Hamleys News

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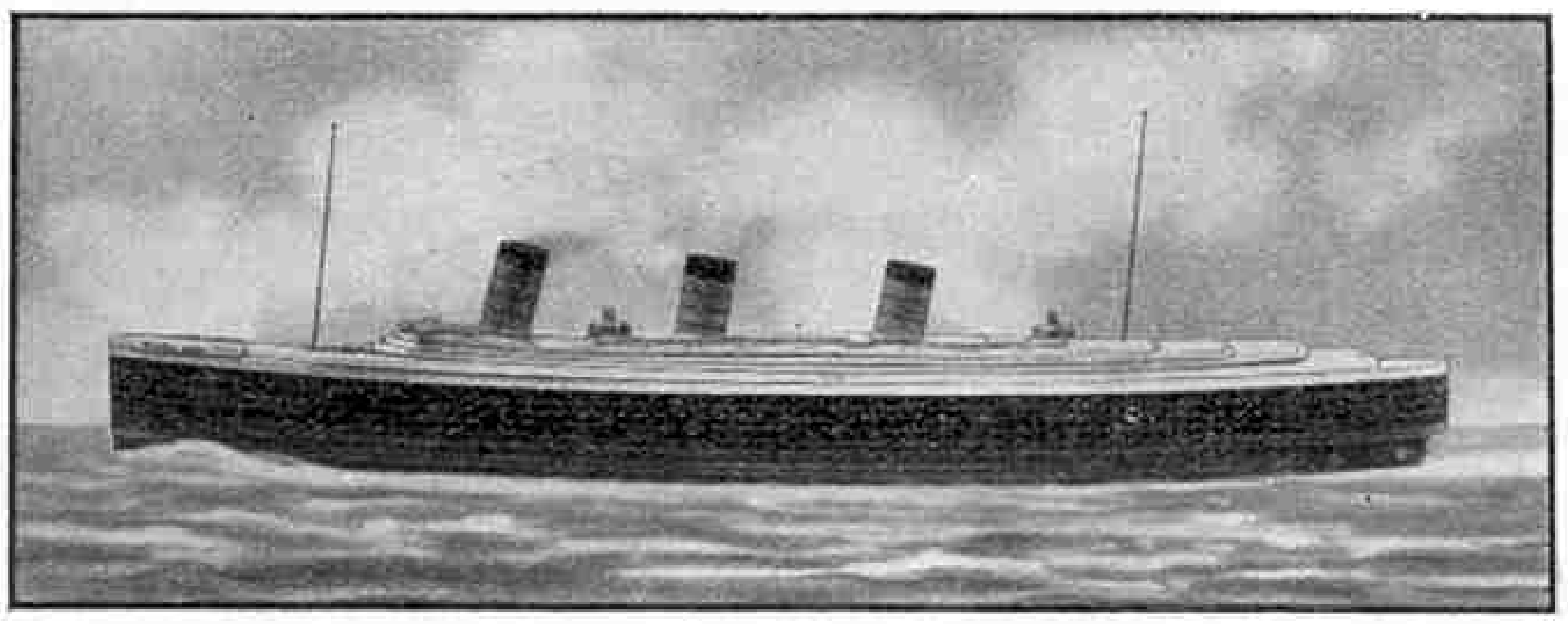
No. 39 *June, 1936*

INTERIOR VIEWS OF THE 'QUEEN MARY'

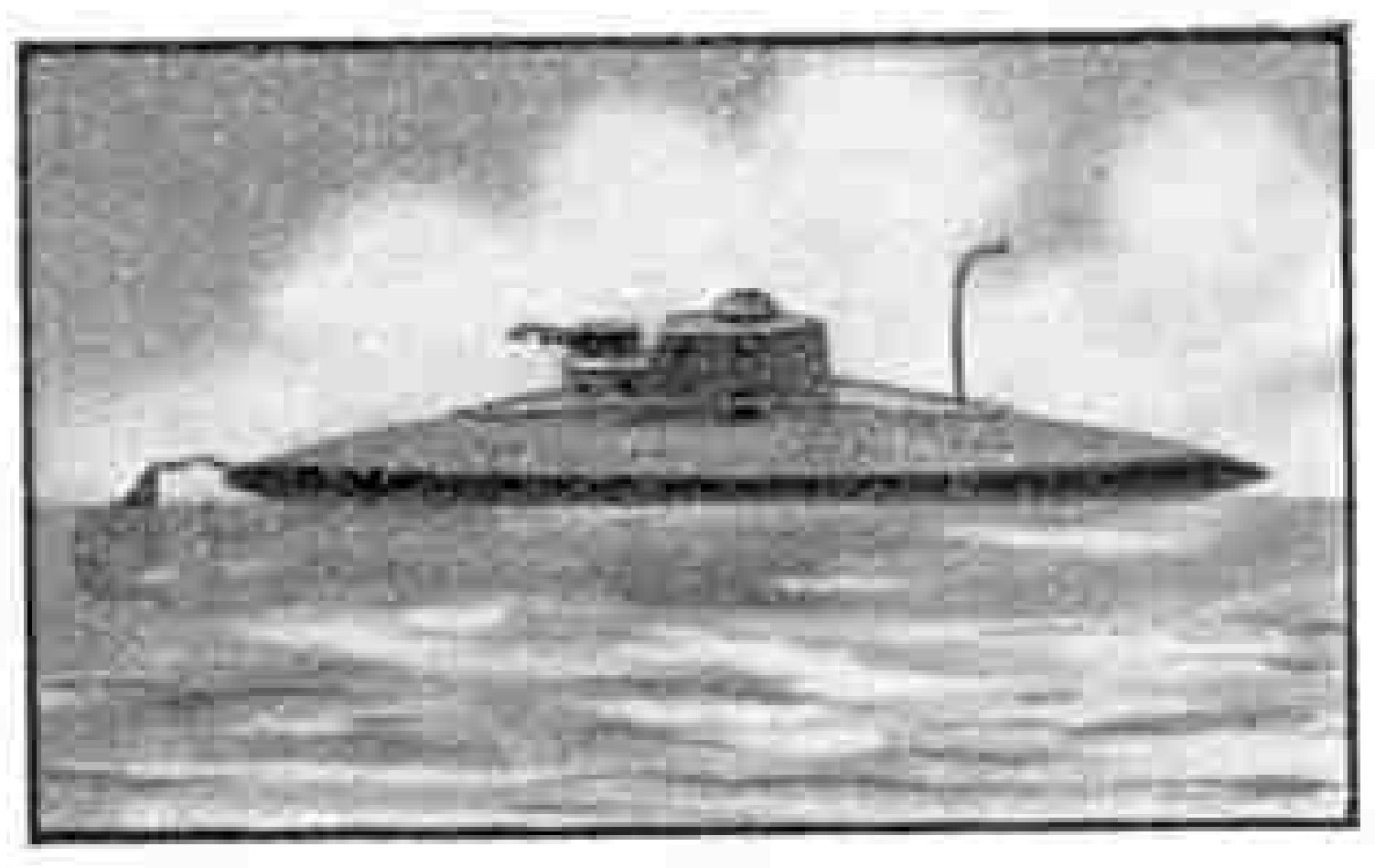
SEE OVER THE "QUEEN MARY"



Now you can have a private interior view of the 'Queen Mary,' the world's greatest liner, with the aid of our new Sectional Model. The boat comes apart deck by deck, and a chart indicates the important features.

Price **3/6** Post 4d.

LATEST TWO-GUN SUB-MARINE



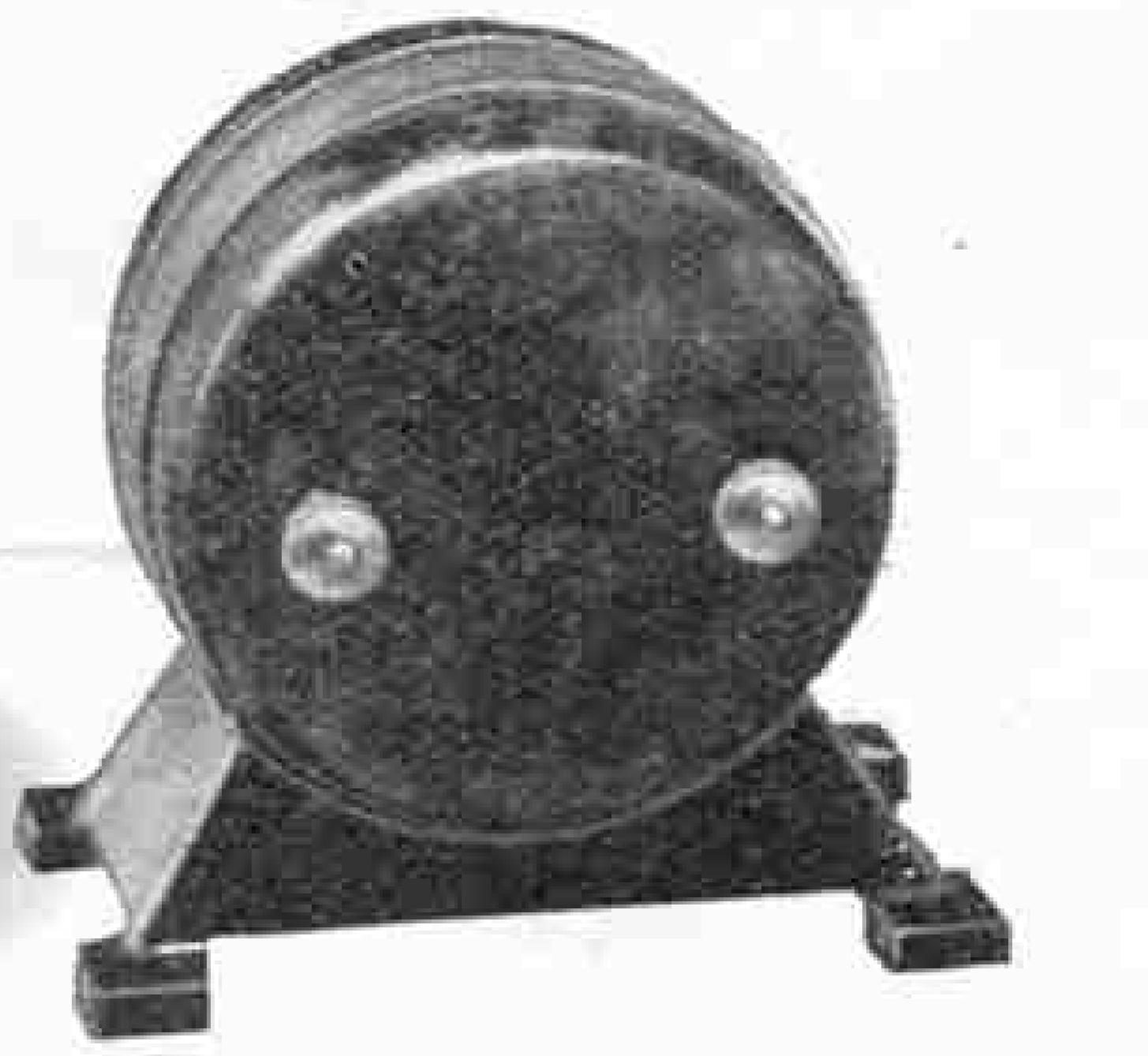
Here is something new in submarines, a beautifully made toy that will really swim under water. The clockwork motor is in a water-tight compartment, and the adjustable rudder enables the vessel to be steered on any course. Foreign.

Price **4/6** Post 6d.

Other Models 3/6, 6/6, 8/6

Own Your Own Power Plant

This powerful electric motor will drive model speed boats,



cranes, windmills, etc. It is driven by a 4-volt flash lamp battery or accumulator. Battery extra.

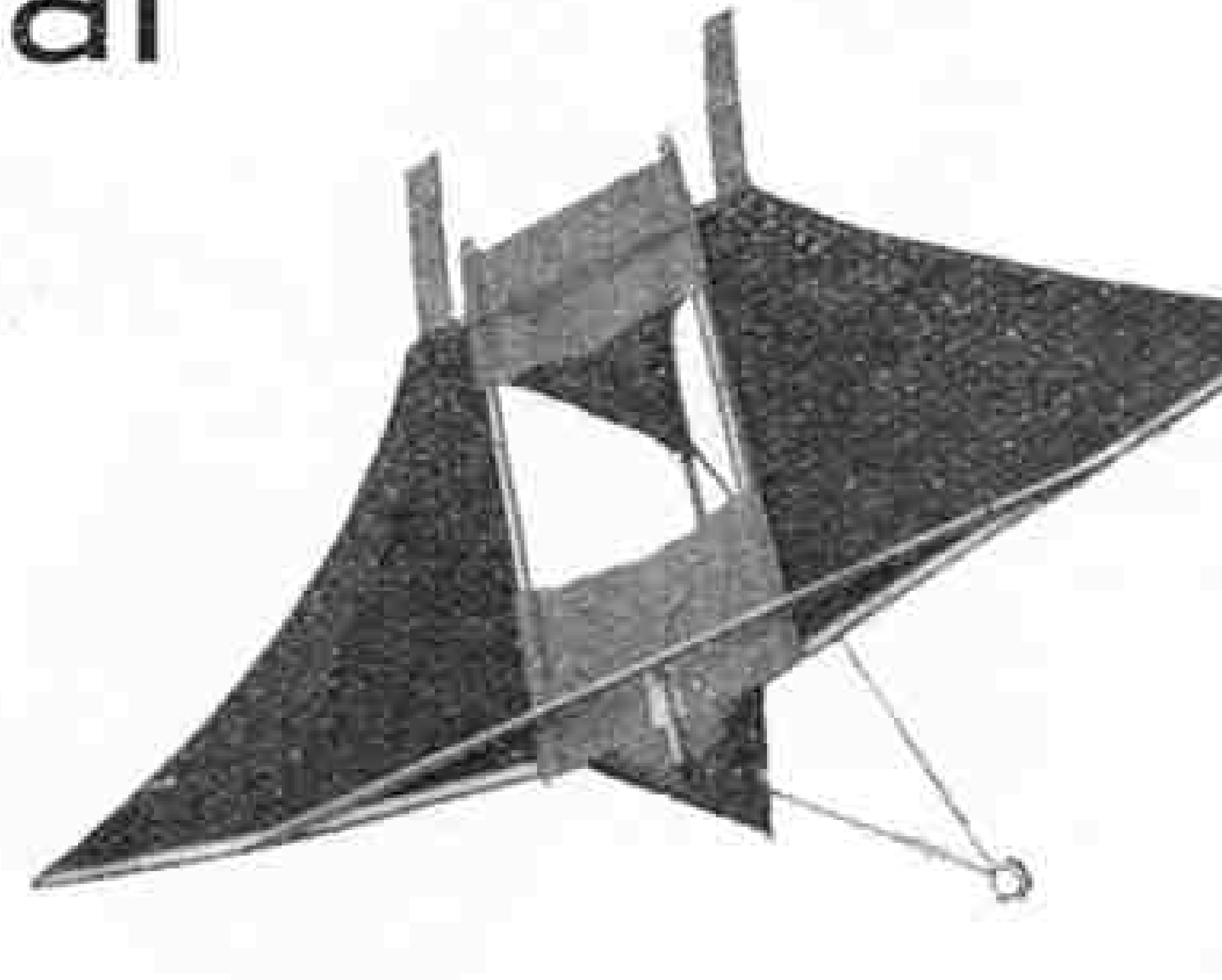
Price **7/6** Post 6d.

SEE THE WORLD AS IT IS

There's a lot of fun to be had with one of these scientifically made telescopes. With a magnification of 3x it will show you things as you have never seen them before. Made of brass tubing with bakelite fittings.

Price **2/11** Post 4d.

Kite That Looks Like a Bird



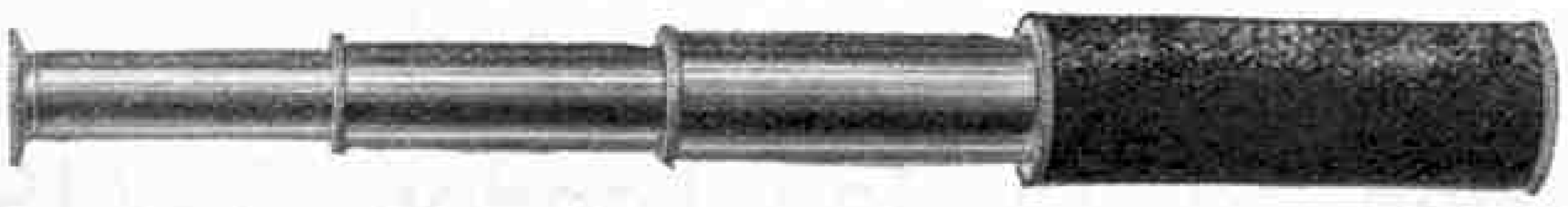
The 'Blue Bird' Kite looks like a bird and flies like one. It's very easy to fly and gives excellent results. Made from strong fabric in two contrasting colours complete with pliable sticks. Cord and Winder 1/- extra.

Price **2/6** Post 4d.

Long Range Telescope

High-power telescope for spotting ships at sea. Made of highly-lacquered cold-drawn solid brass tubing. 1¼ in. objective, magnification 12x, corrected 4 lens eyepiece.

Post 6d. Price **15/-**



KNOW WHERE YOU'RE GOING!

No chance of getting lost with this precision-made magnetic compass. Made with bevelled glass, dial accurately divided to 360°, giving all cardinal points. Foreign.

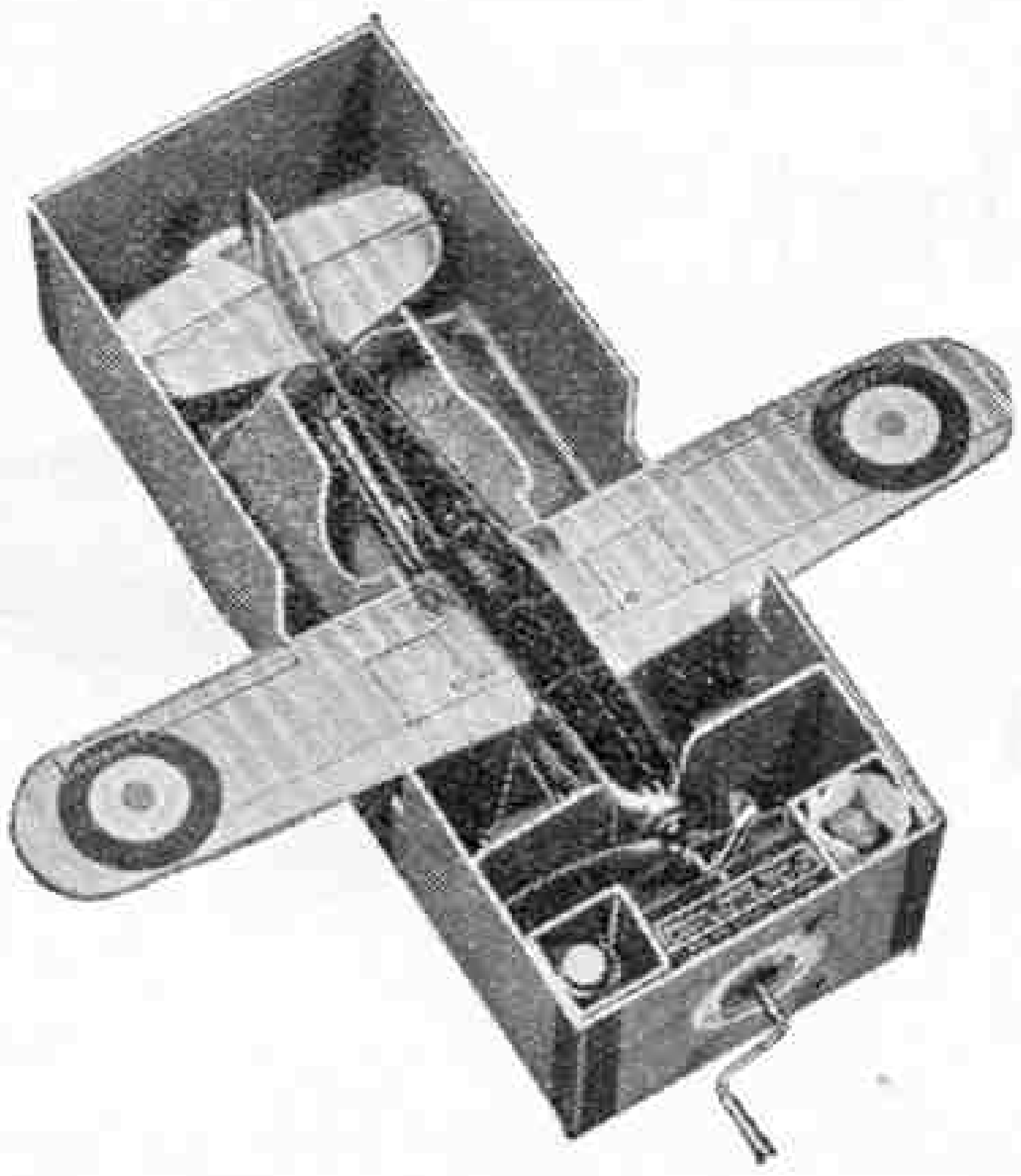
Price **1/11** Post 3d.

FROG scale models

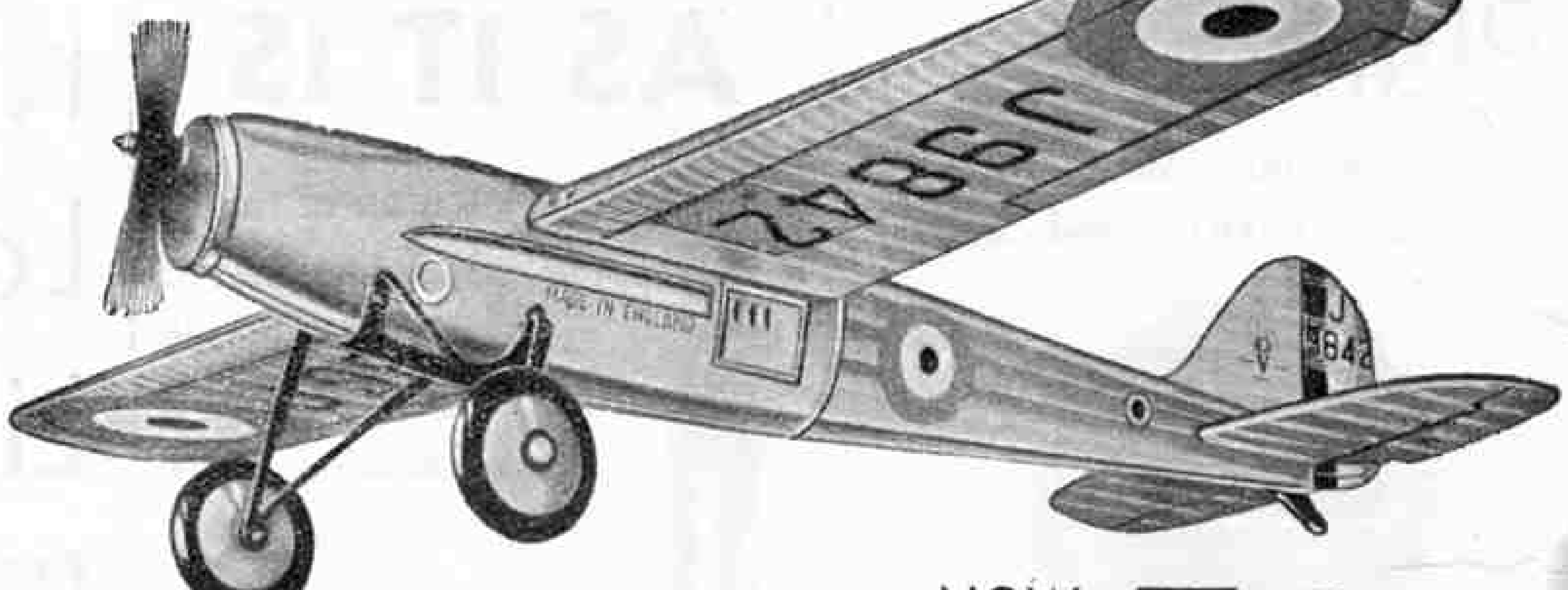
To-day's FROG owners
are to-morrow's pilots

FROG PUSS MOTH MONOPLANE

A handsome flying scale model of the famous De Havilland light aeroplane in which many records have been broken. Wing Span 18½″. Length 13½″. Complete with Patent High-Speed Winder Box, Spare Motors, Dual Insertor Rod, Motor Lubricant, Gear-box Oil and fully illustrated Instruction Manual. Flights of 600 ft. can be obtained under favourable conditions. **17/6**



This illustration shows how quickly the Frog scale models are wound for flight with the geared-up winder box. A PATENT AND EXCLUSIVE "FROG" FEATURE.



FROG INTERCEPTOR FIGHTER MK.IV

NOW ONLY **5/-**

The original and now famous flying scale-model Interceptor Fighter. Wing Span 11½″. Duralumin Fuselage. Complete with Patent High-Speed Winder Box, Spare Motors, Insertor Rod, Motor Lubricant, Gear-box Oil and fully Illustrated Instruction Manual. With practice it will fly 300 ft.

COUPON To Lines Bros. Ltd. (Dept. 5)
Morden Road, London, S.W.19

Please send me your "Frog" coloured leaflet with particulars of the "Frog" Flying Club and how to obtain handsome enamelled Air Force pilot badges.

NAME ....

ADDRESS ....

Please write in block letters. 6/36

FREE FLIGHT INSTRUCTION

Lines Bros. will give free flight instruction by appointment on the Frog Aerodrome at Merton.

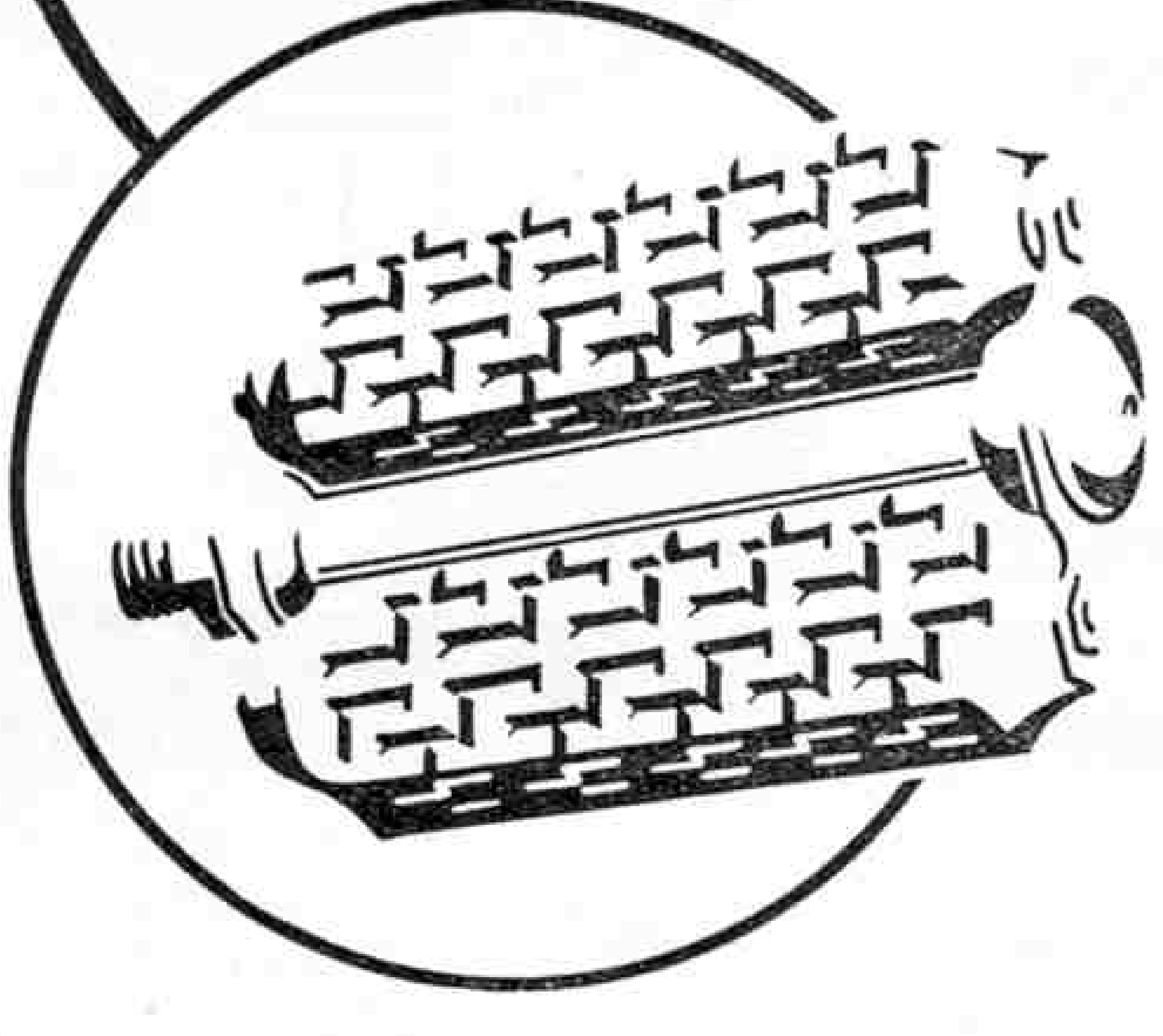
Telephone: Liberty 1041.

Frog Scale model aircraft designed and made by International Model Aircraft Ltd. Patented throughout the world. Sole Concessionaires:

LINES BROS. LTD., Tri-ang Works, Morden Rd., Merton, London, S.W.19

Change now to

**SMARTNESS
SAFETY
COMFORT**



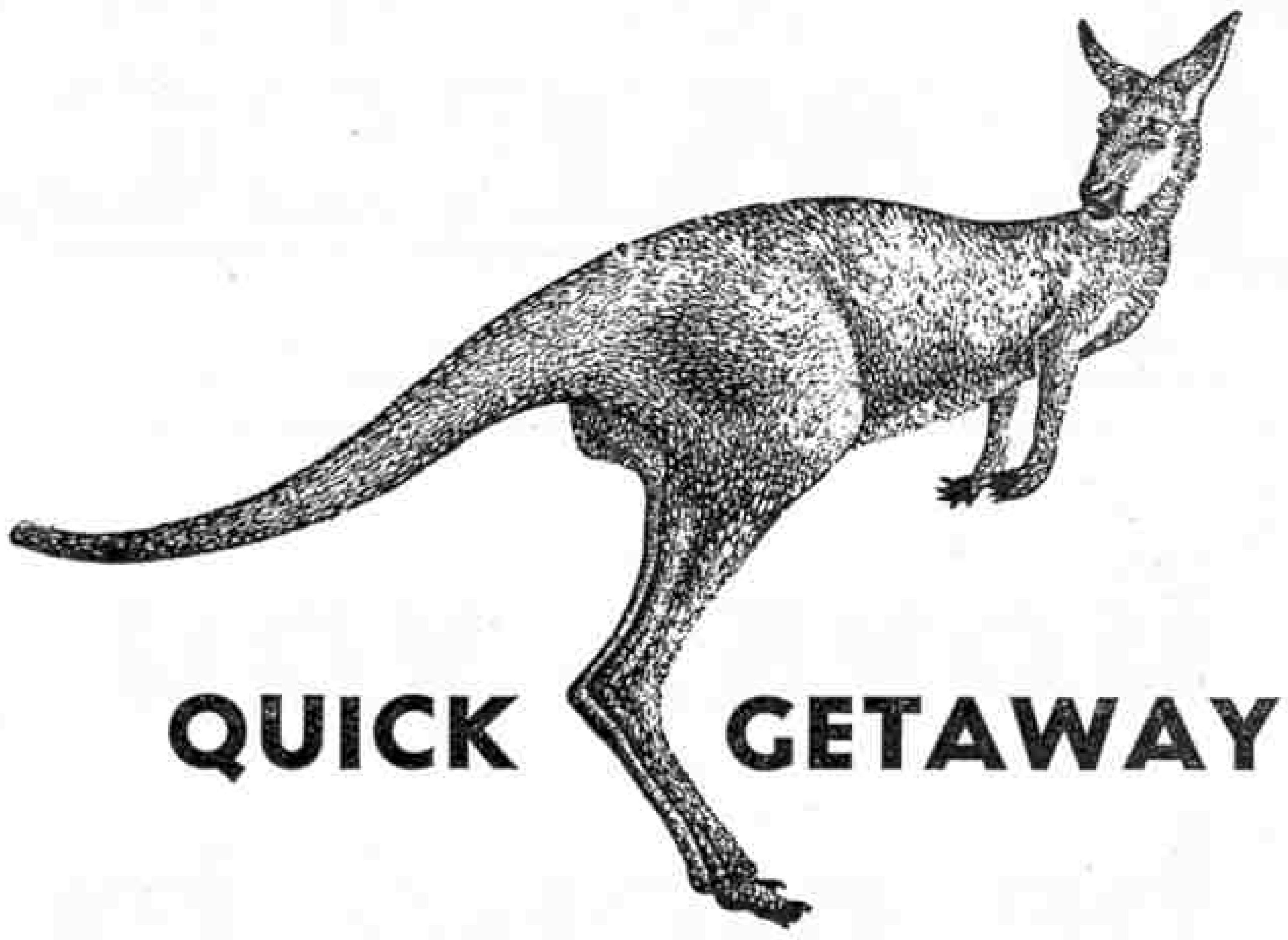
Replace your old, out-dated pedals with the latest development in cycling—Brampton "Mark 10" pedals. Get a free leaflet from a dealer describing **all** the new and patented improvements. Rubber, rat-trap and racing designs, prices 2/3 to 2/8 per pair.

BRAMPTON "MARK 10"

If your cycle is fitted with BRAMPTON FITTINGS—it's a good one.

FREE—Write for "Easy Running for Cyclists" booklet.

THE RENOLD & COVENTRY CHAIN CO. LTD., Manchester, England



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You will find Bluemel's Mudguards, Pump and Reflector on the specifications of all the best cycles, and experienced clubmen fit them as a matter of course.

Send for pocket catalogue containing useful cycling data to

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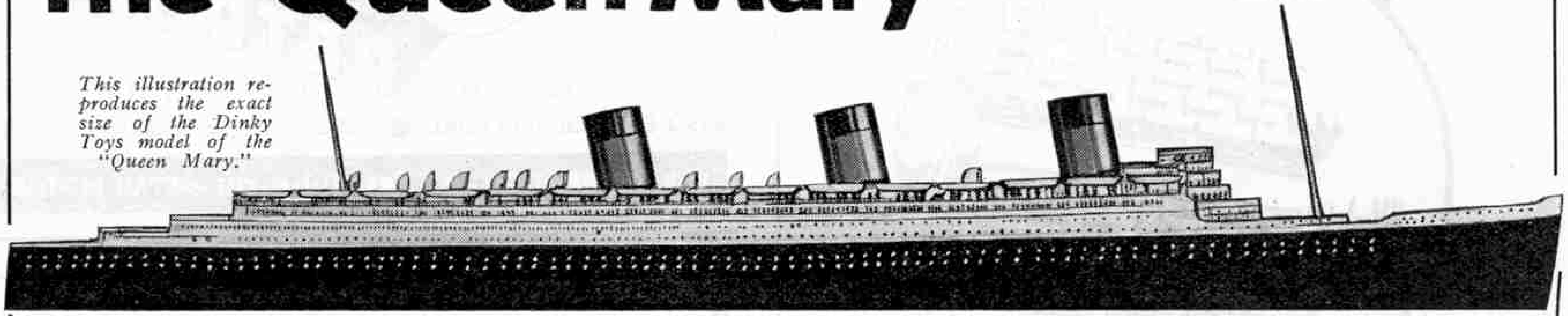
TOYS OF QUALITY MADE BY
MECCANO LTD.

Boys! you will be proud to own this fine model of the "Queen Mary"



This illustration reproduces the exact size of the Dinky Toys model of the "Queen Mary."

A SOUVENIR OF A GREAT ACHIEVEMENT

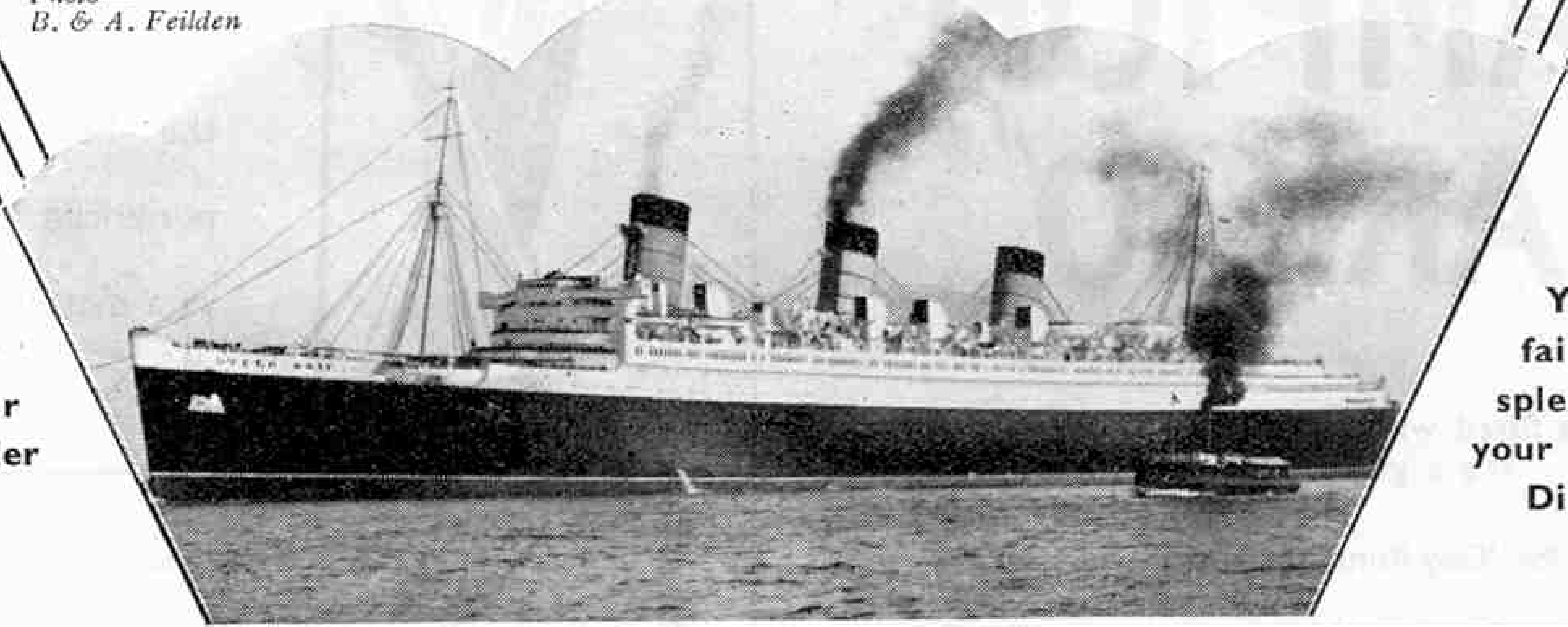
Every boy should have one of these fine Dinky Toys miniatures to keep as a souvenir of the wonder ship "Queen Mary," the most magnificent liner yet built. The model is a splendid reproduction of the giant vessel on a scale of 1 in. to 150 ft., and it emphasises the graceful lines that make her the stateliest ship in the world. All external details, from the great wheelhouse and bridge to the motor lifeboats and the ventilators, are faithfully reproduced. The miniature is finished in correct Cunard White Star colours.

DINKY TOYS

No. 52A
Cunard White Star Liner
"Queen Mary"

Price 1/-

Photo—
B. & A. Feilden



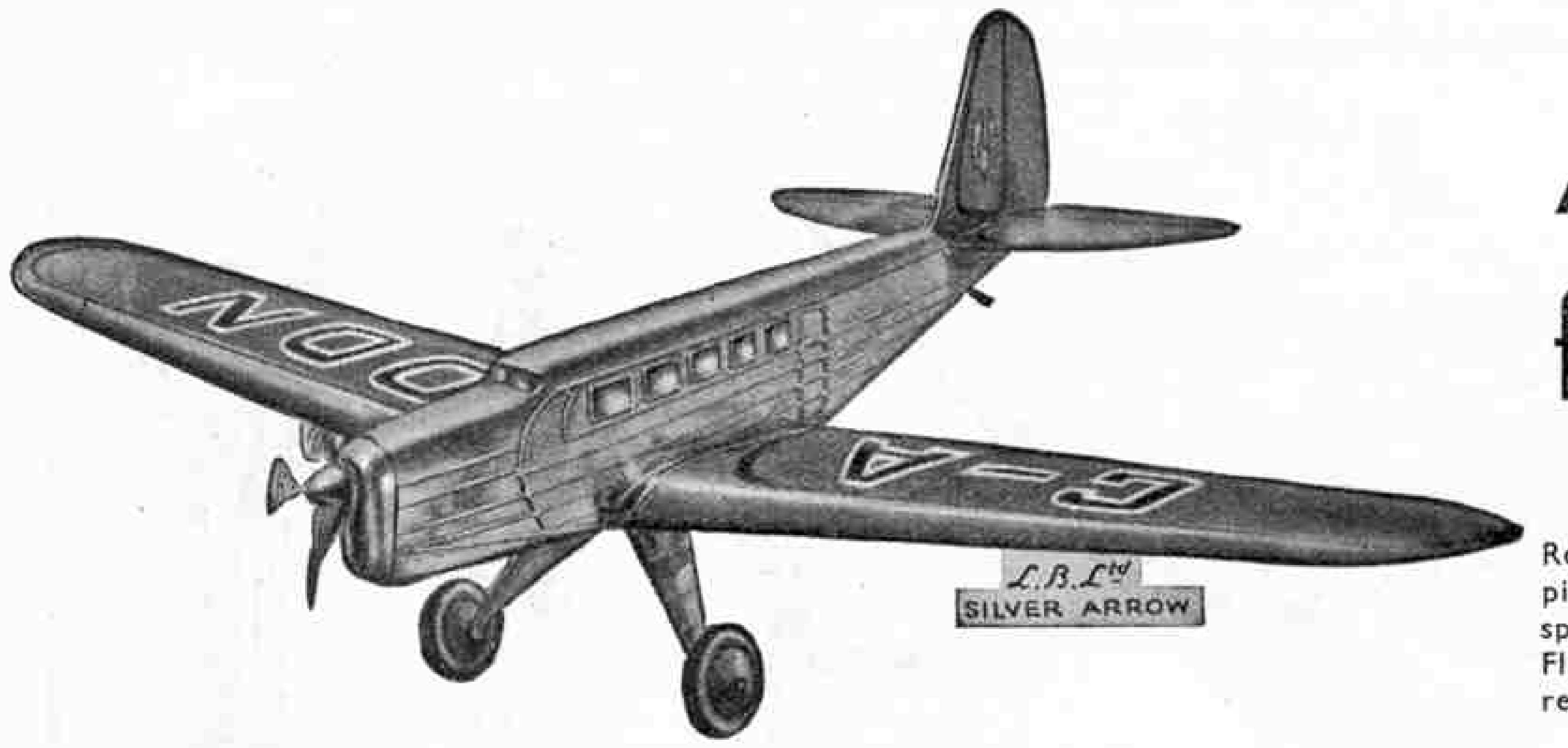
Get the Dinky Toy Model of this wonderful liner from your Dealer to-day.

You must not fail to add this splendid model to your collection of Dinky Toys.

MECCANO LTD. - - BINNS ROAD - - LIVERPOOL 13

FROG MODEL AIRCRAFT

TRADE MARK REGD.



A real flying model for only half-a-crown

Read the specification: Aluminium fuselage; detachable propeller and nose piece; accurate pitch propeller; adjustable controls; transparent windows; wing span 16½ in.; spare motor and insertor rod; double-surface detachable wings. Flies 100 to 120 ft. To obtain the best results lubricate your elastic motor regularly with Frog Motor Lubricant. Price 2d. per bottle.

THE "SILVER ARROW"

Low Wing Monoplane Single Engine Air Liner

Price only **2/6**

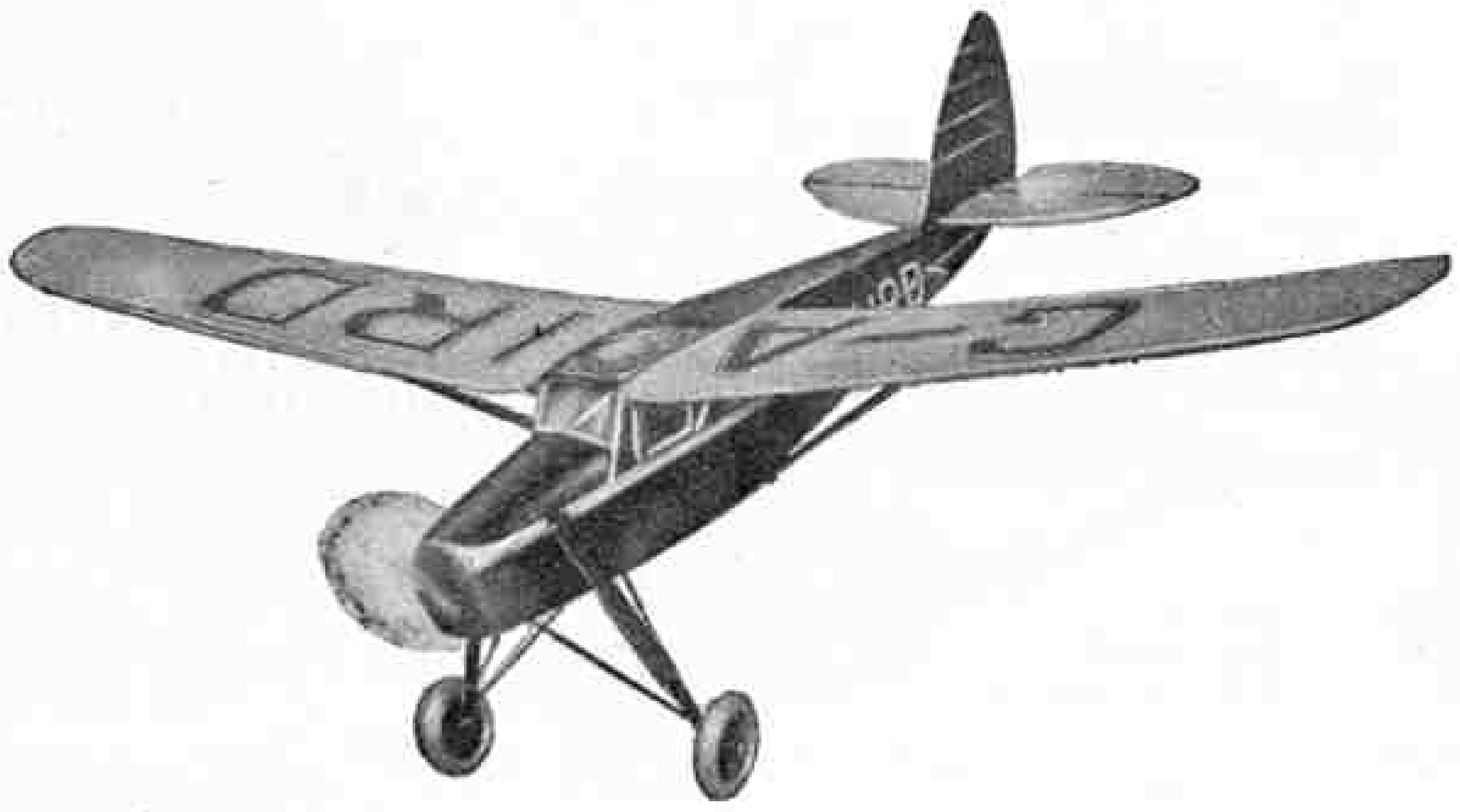
BUILD YOUR OWN FLYING SCALE MODELS

New low-priced CONSTRUCTION kits

De Havilland "LEOPARD MOTH" **2/6**
Wing Span 12¼ in. Length 9½ in.

De Havilland "HORNET MOTH" **3/6**
Wing Span 11 in. Length 9½ in.

Hawker "DEMON" 2-seater Fighter **4/6**
Wing Span 12¼ in. Length 11 in.



Actual photo of completed model of De Havilland "Leopard Moth."

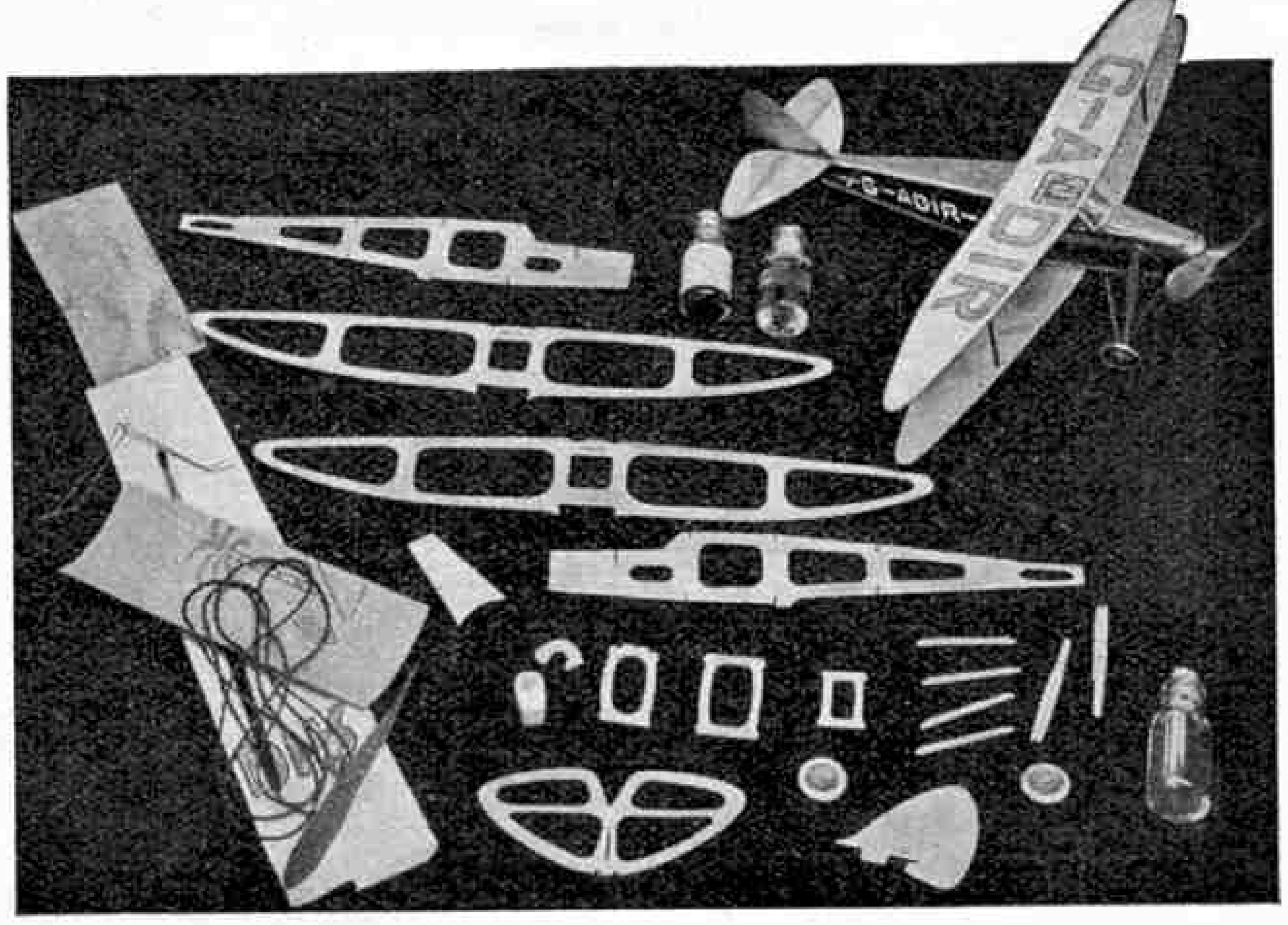
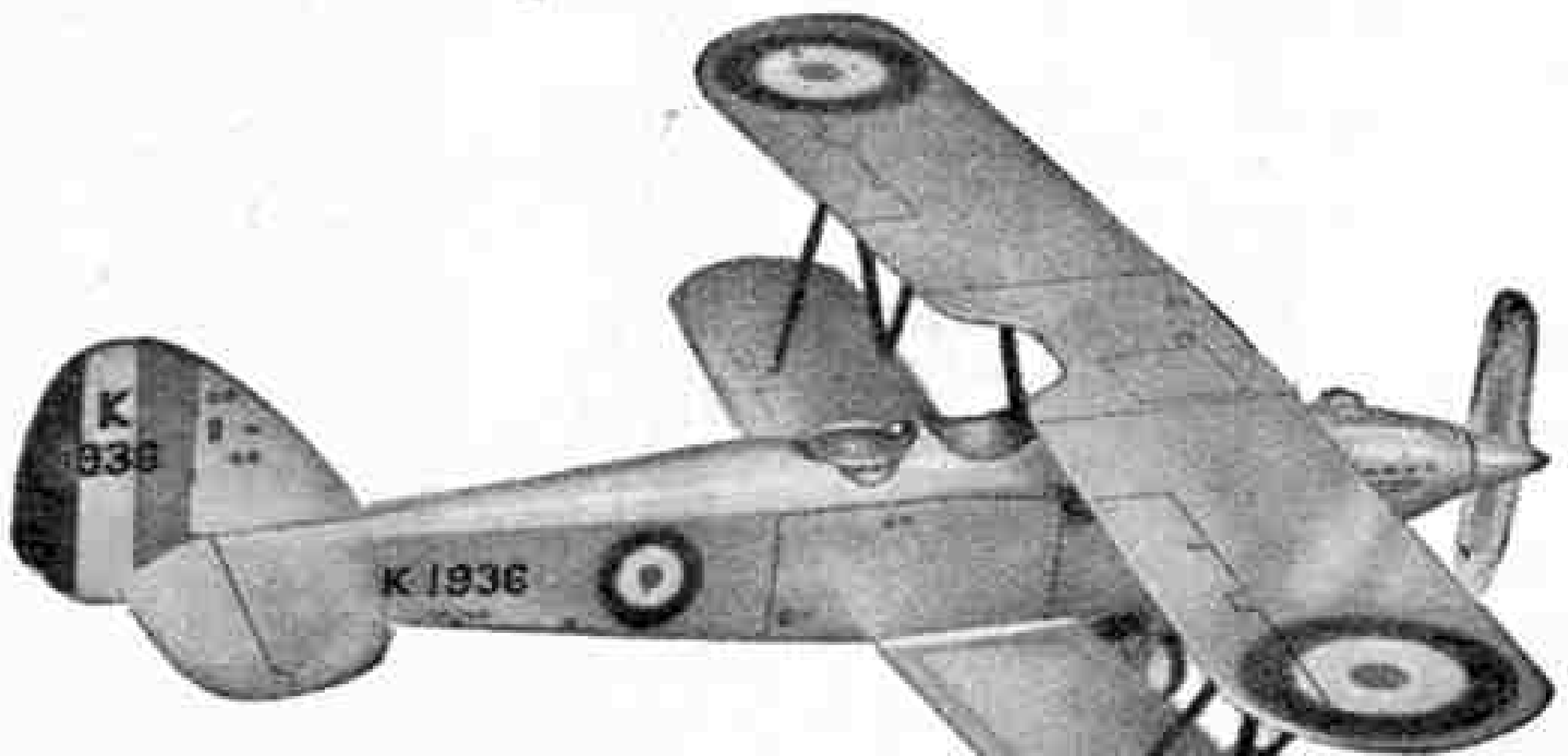


Photo of completed De Havilland "Hornet Moth"; also construction kit.

These construction kits enable the enthusiast to build his own Flying Scale Models. They are easy to build and no tools are required. All parts are blanked out and fit together perfectly, only needing to be glued. (This is supplied.) Wire parts are already bent to shape. No paint is required, all coverings are printed in the correct colours. Supplied complete with motor lubricant and spare motor.



Actual photo of completed model of the Hawker "Demon."

FREE FLIGHT INSTRUCTION

Lines Bros. will give free flight instruction by appointment on the Frog Aerodrome at Merton. Telephone: Liberty 1041.

COUPON To Lines Bros. Ltd. (Dept. 5)
Morden Road, London, S.W.19

Please send me your "Frog" coloured leaflet with particulars of the "Frog" Flying Club and how to obtain handsome enamelled Air Force pilot badges.

NAME ....

ADDRESS ....

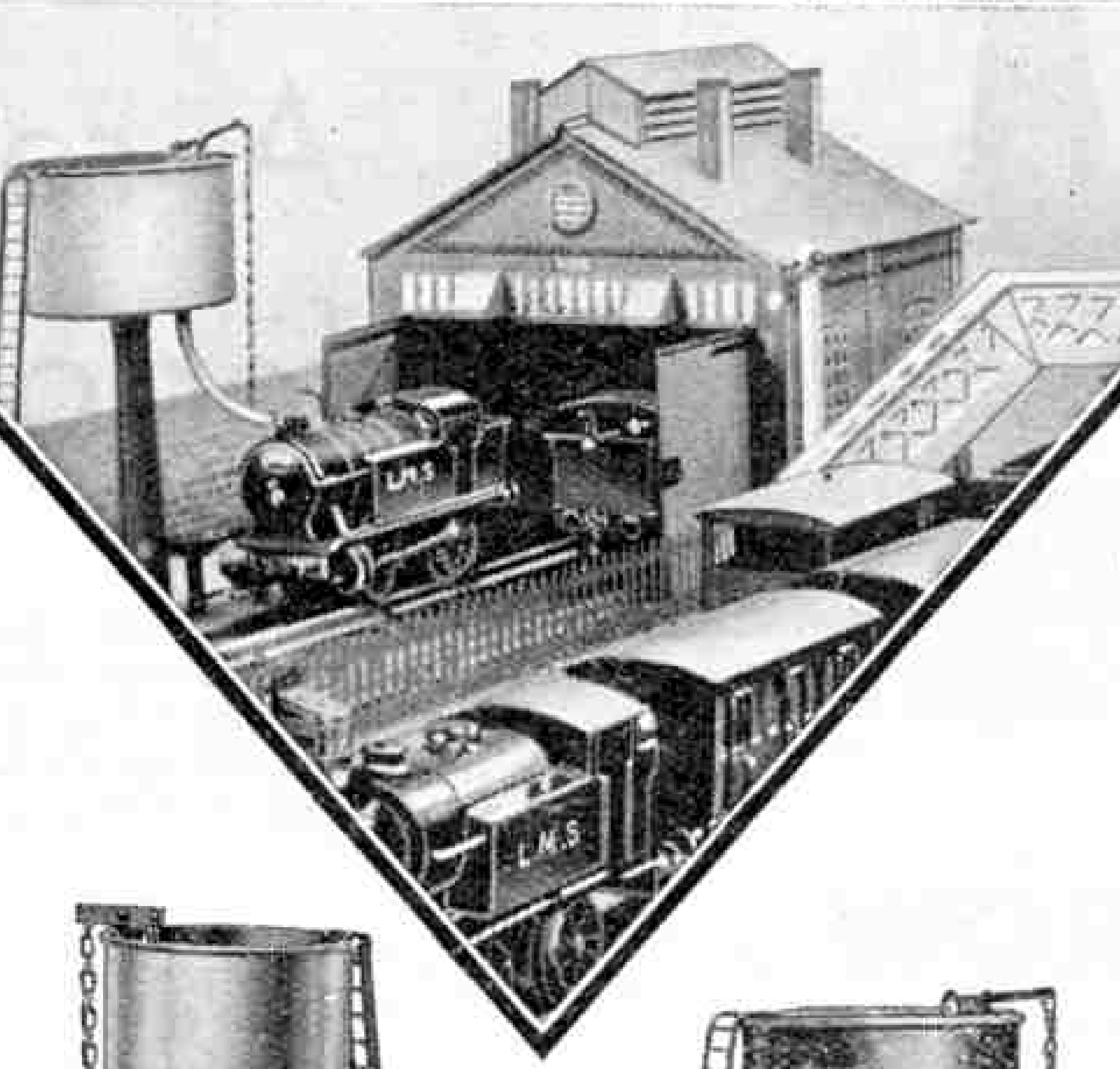
Please write in block letters. 6/36

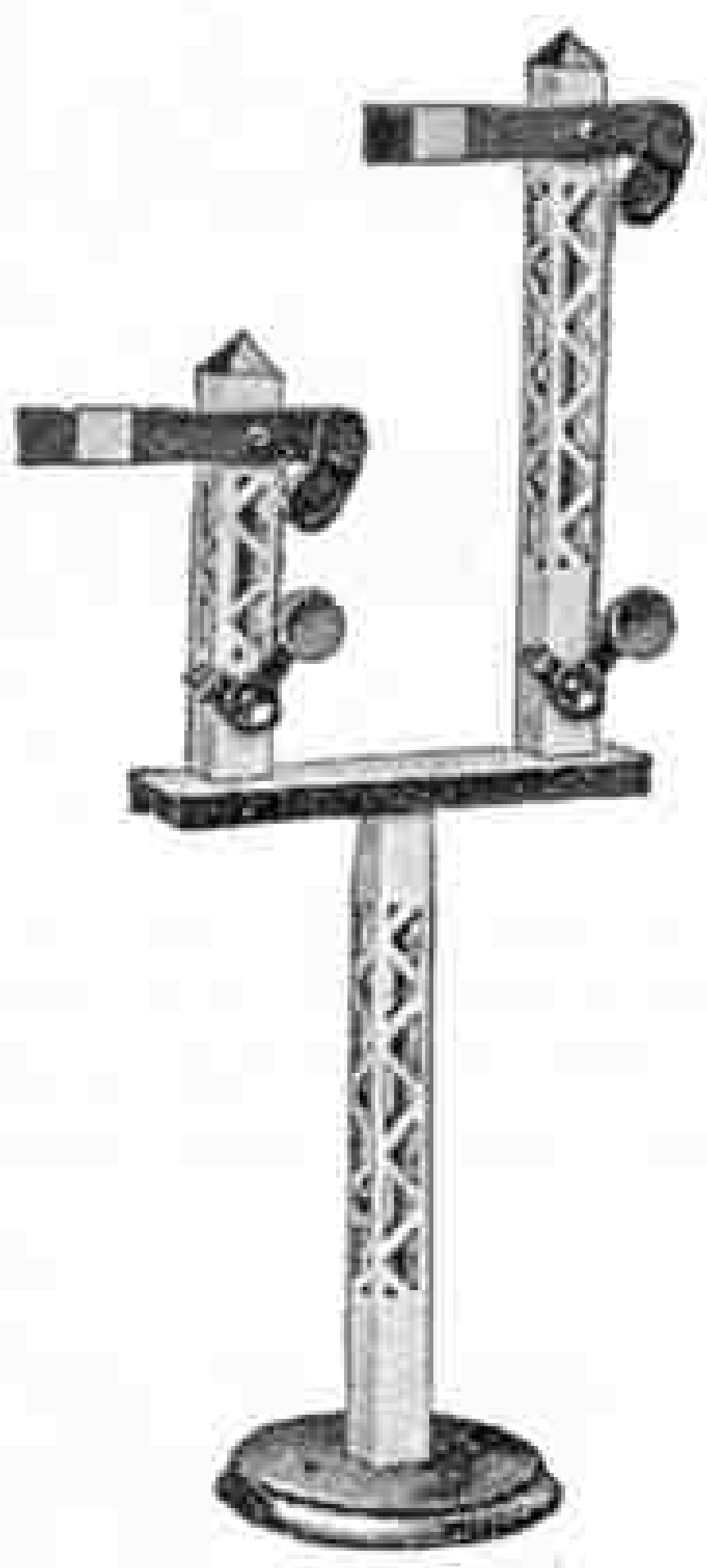
Frog model aircraft designed and made by International Model Aircraft Ltd. Patented throughout the world. Sole Concessionaires:

LINES BROS. Ltd., Tri-ang Works, Morden Rd., London, S.W.19

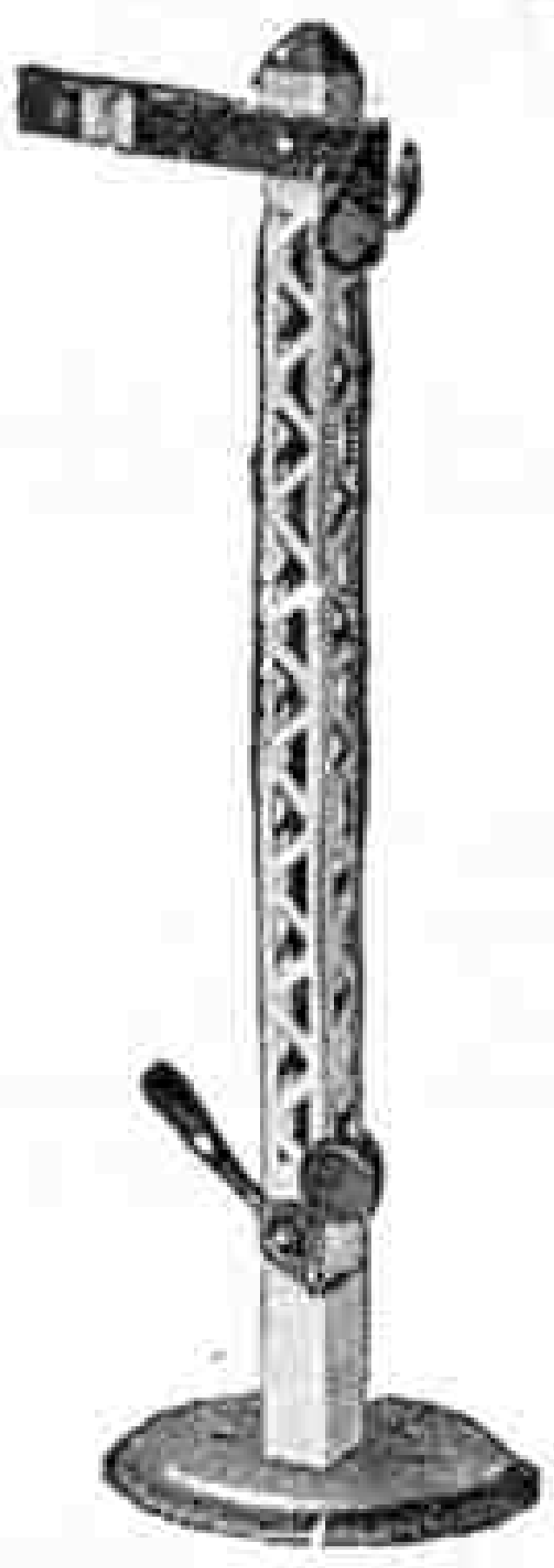
Hornby Series **HORNBY ACCESSORIES** Gauge O

There is a splendid range of Railway Accessories in the Hornby Series, each one built in perfect proportion and beautifully finished. With these realistic accessories the most elaborate model railway may be constructed and operated in exactly the same manner as a real railway. A selection of Hornby Accessories is shown on this page. Ask your dealer to show you the full range.

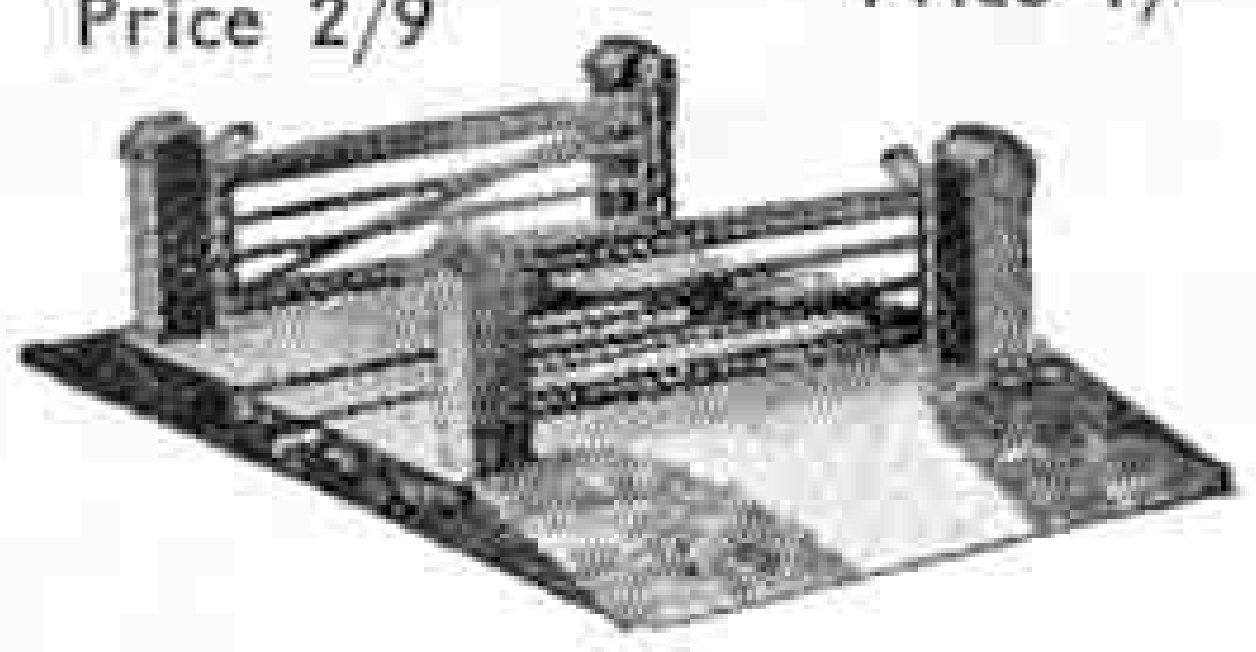




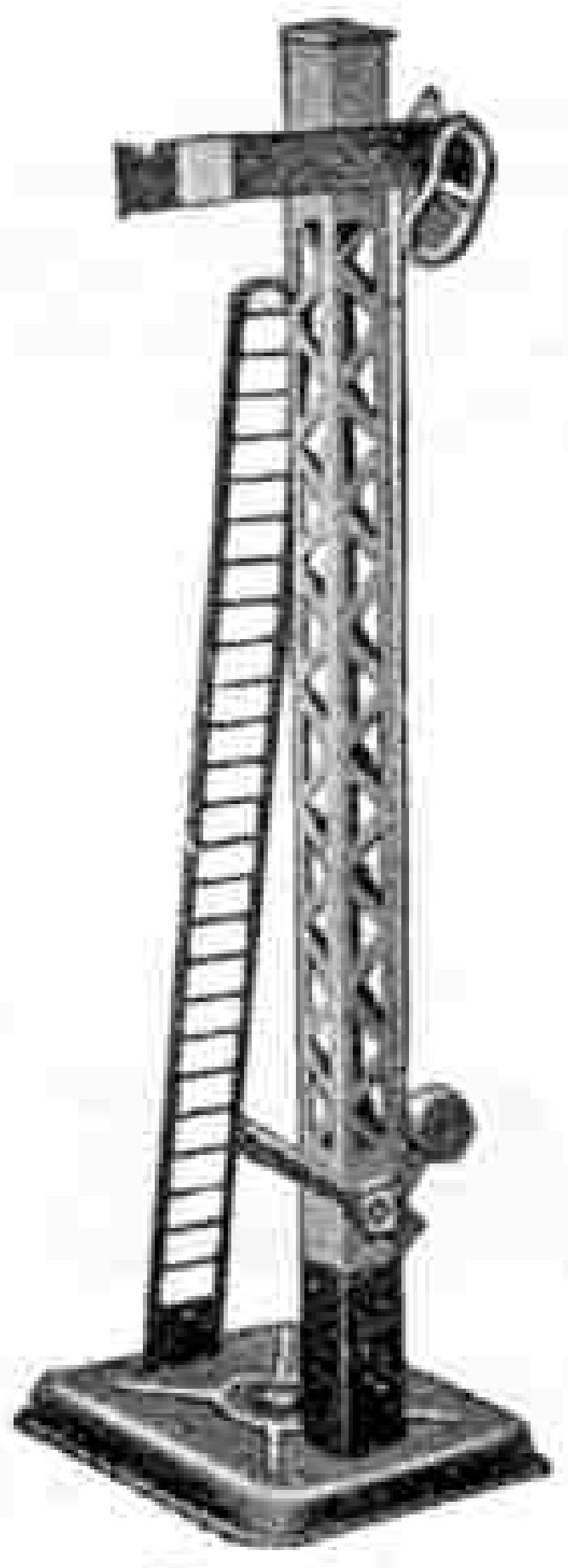
No. 1 JUNCTION SIGNAL
"Home" or "Distant."
Price 2/9



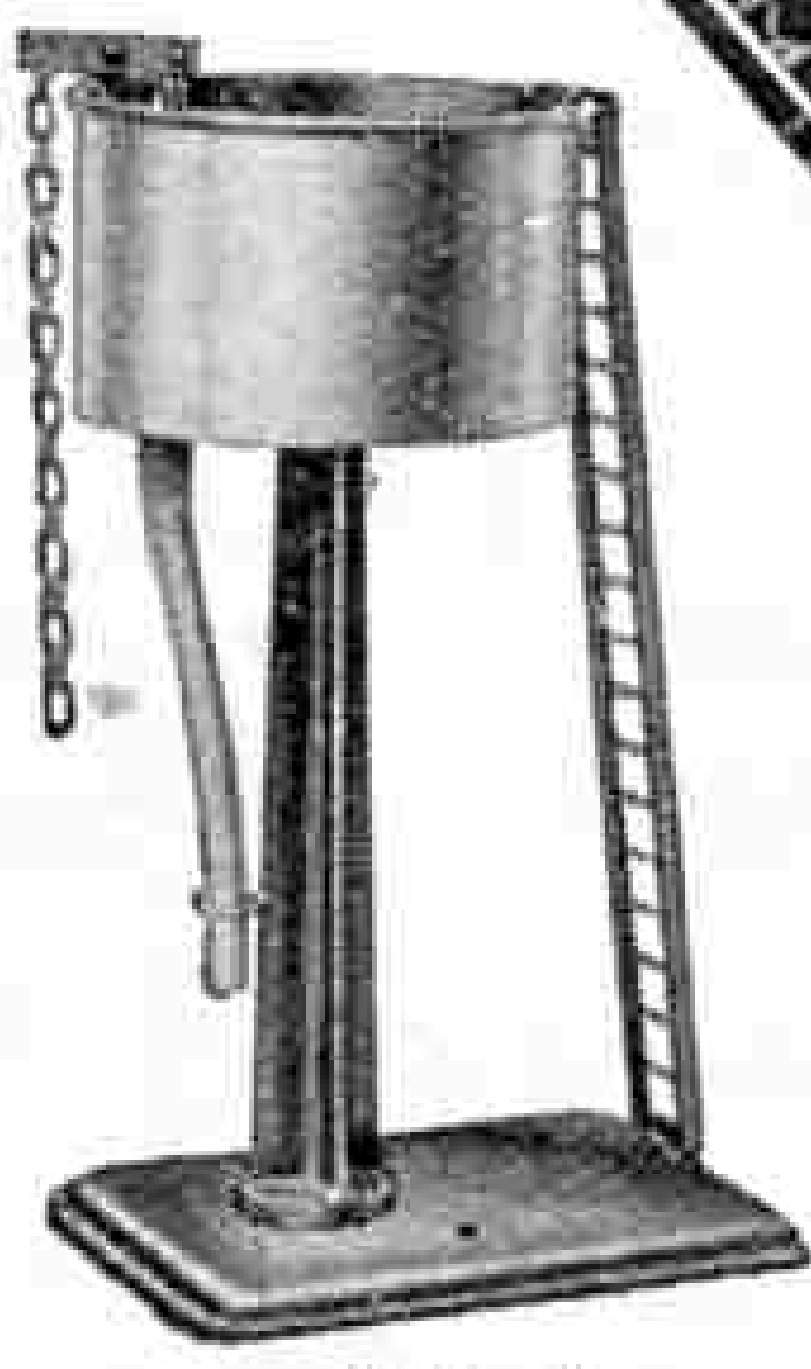
No. 1 SIGNAL
"Home" or "Distant."
Price 1/-



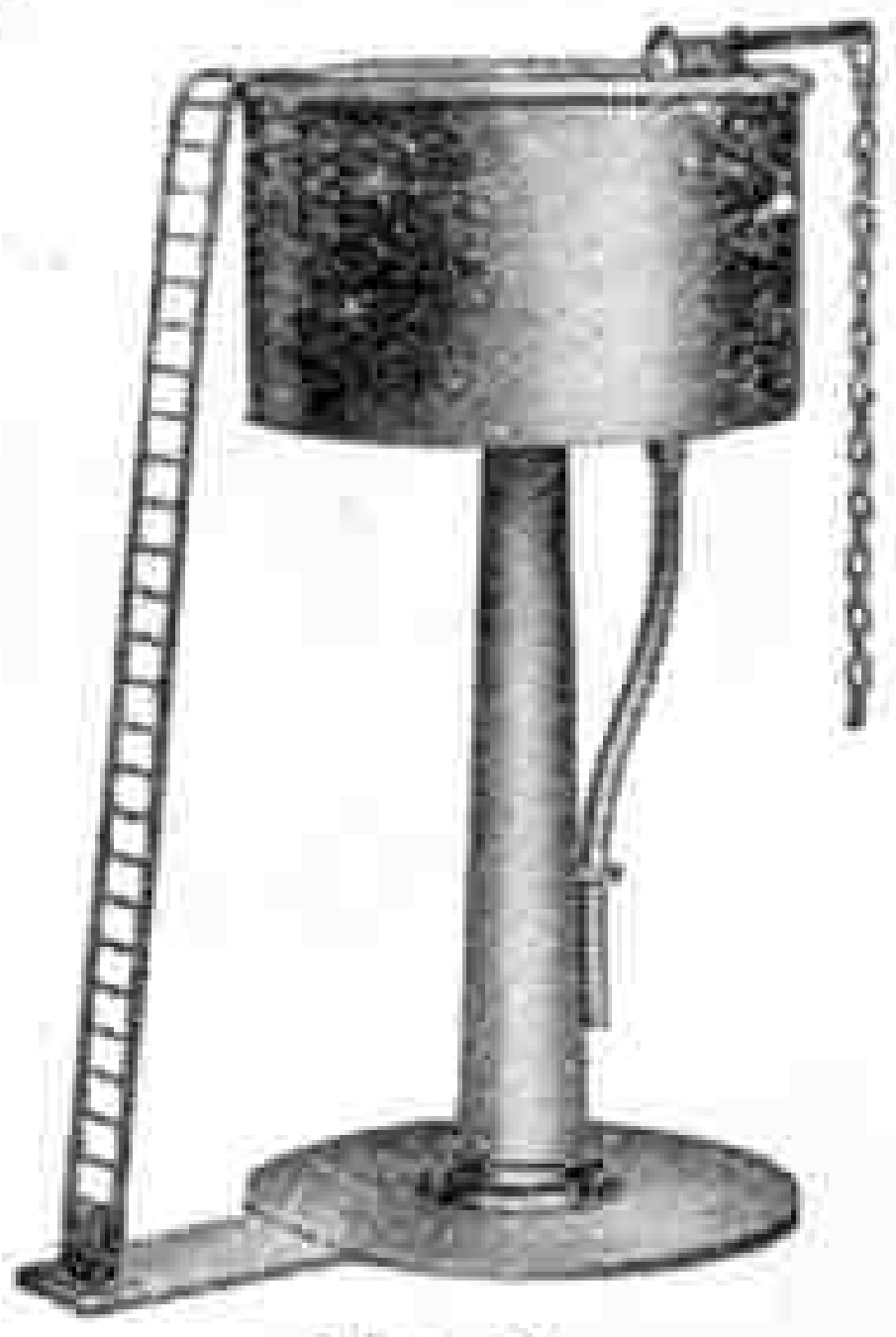
No. 1 LEVEL CROSSING
Suitable for a single track only and has gauge O rails in position.
Price 2/11



No. 2 SIGNAL
"Home" or "Distant."
Price 2/-



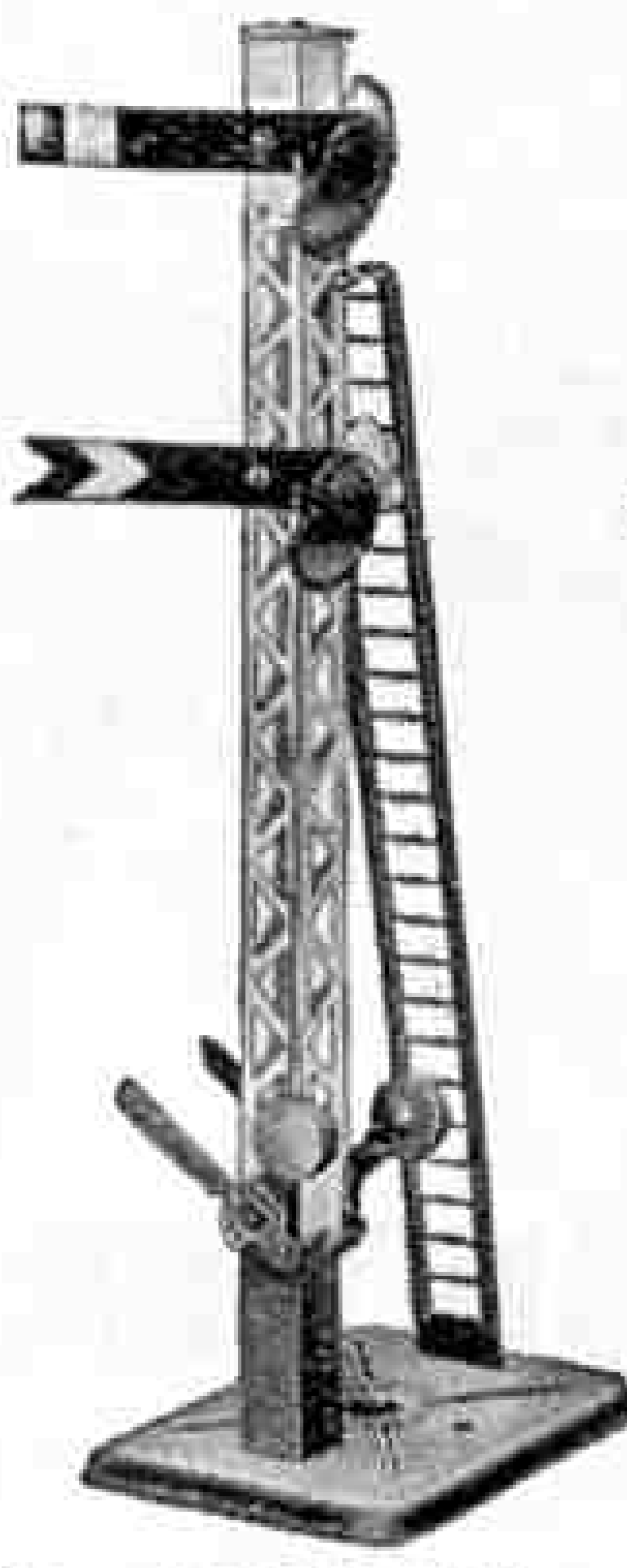
No. 1 WATER TANK
Height 7 in.
Fitted with flexible tube and valve lever.
Price 3/-



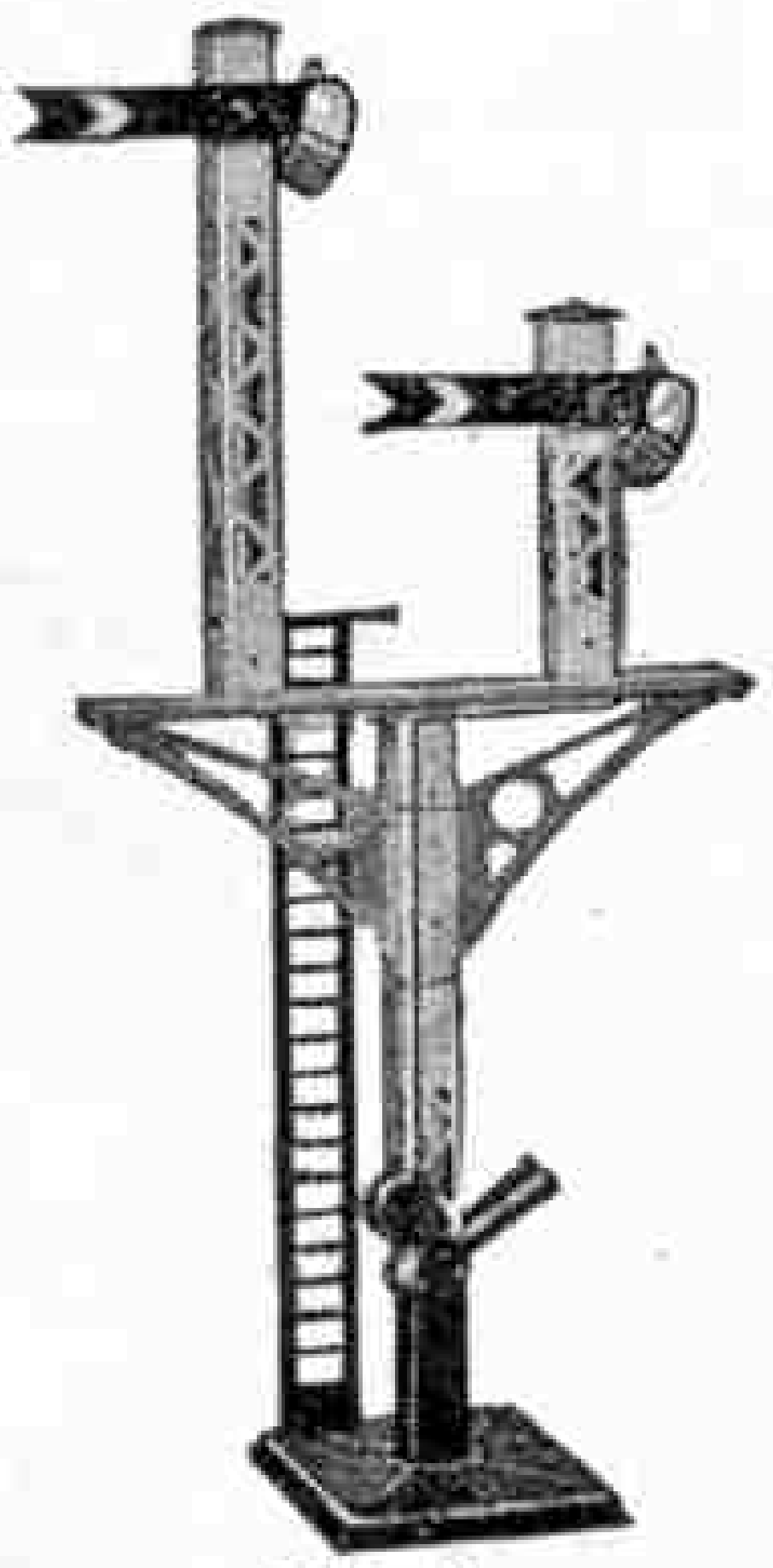
No. 2 WATER TANK
Height 9 in.
Fitted with flexible tube and valve lever.
Price 5/9

No. 1 SIGNAL, DOUBLE ARM
"Home" and "Distant."
Price 1/6

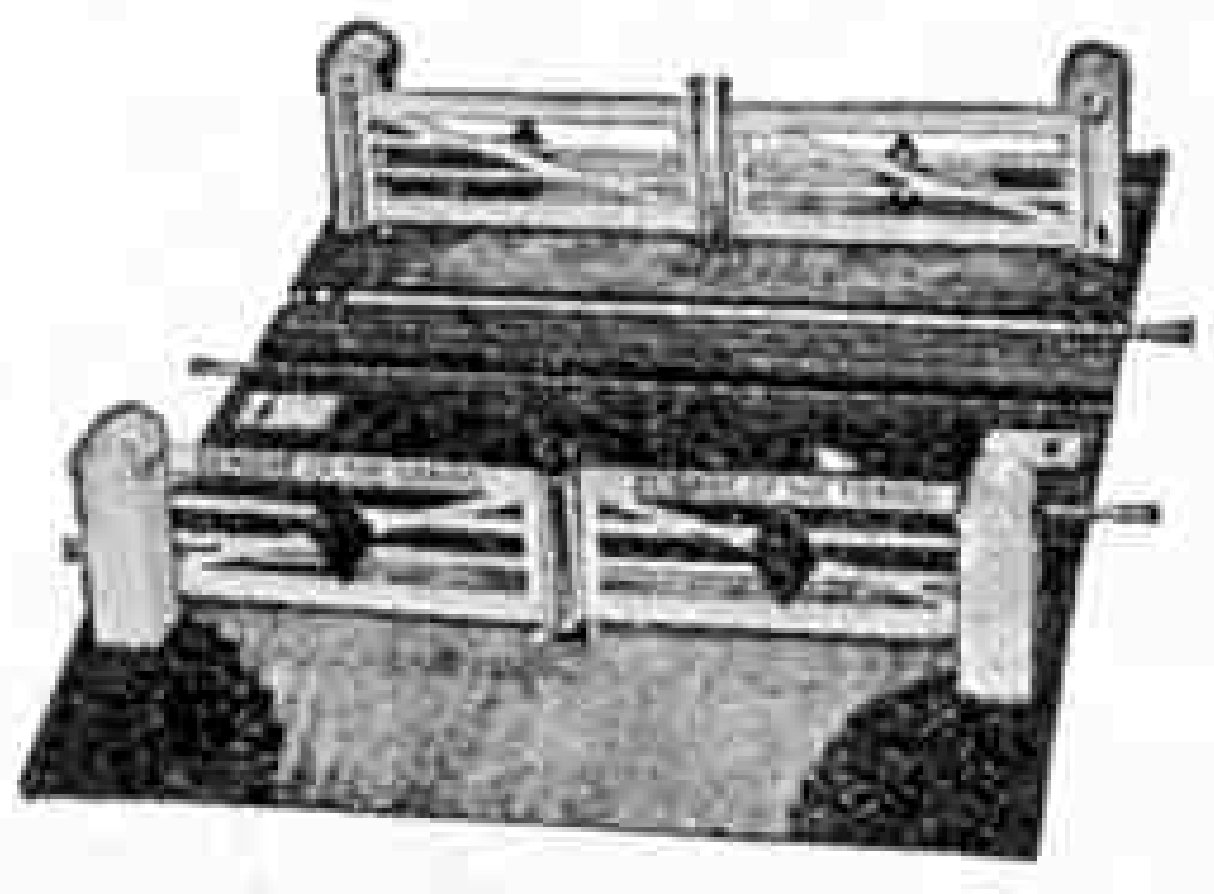
MECCANO LUBRICATING OIL
Price per bottle 6d.



No. 2 SIGNAL, DOUBLE ARM
"Home" and "Distant."
Price 2/6

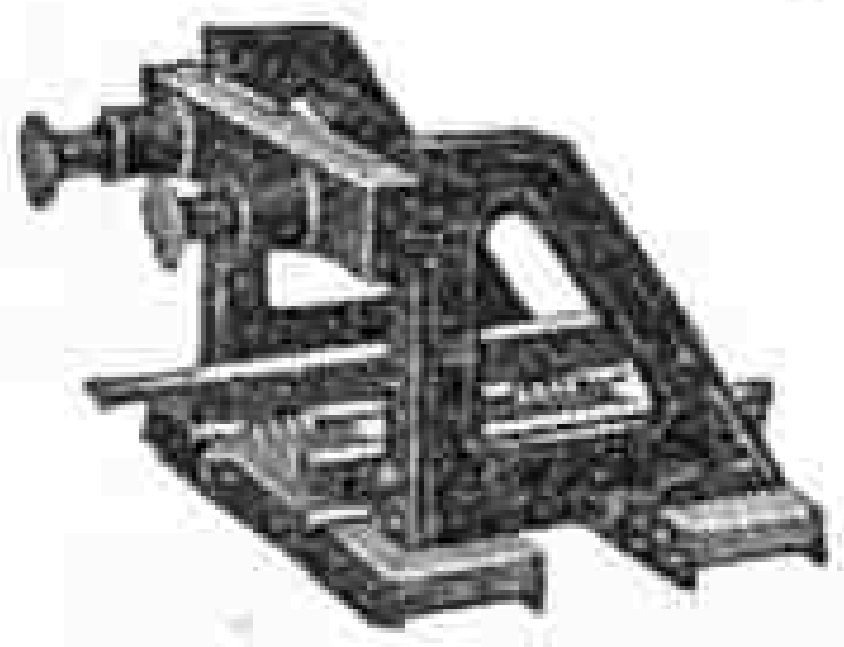


No. 2 JUNCTION SIGNAL
"Home" or "Distant." Signal arms operated by levers at base. A very realistic model. Price 4/9

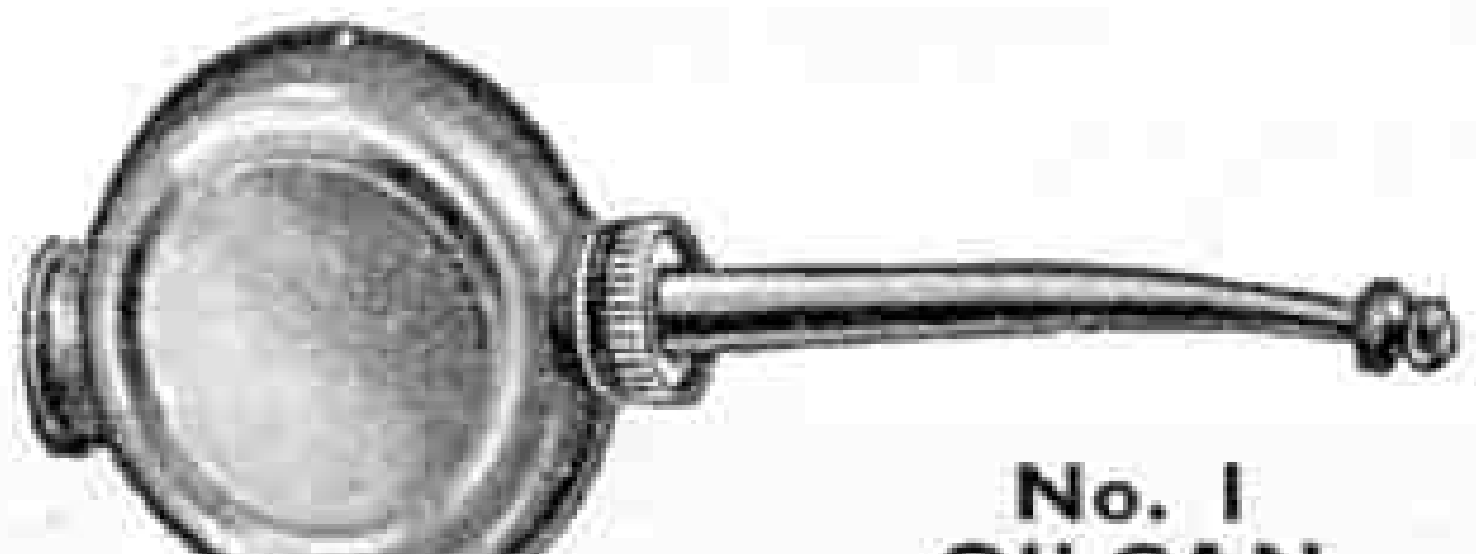


No. 2 LEVEL CROSSING
Measures 13½ x 10½ in., with two tracks of gauge O rails in position.
Price 5/6

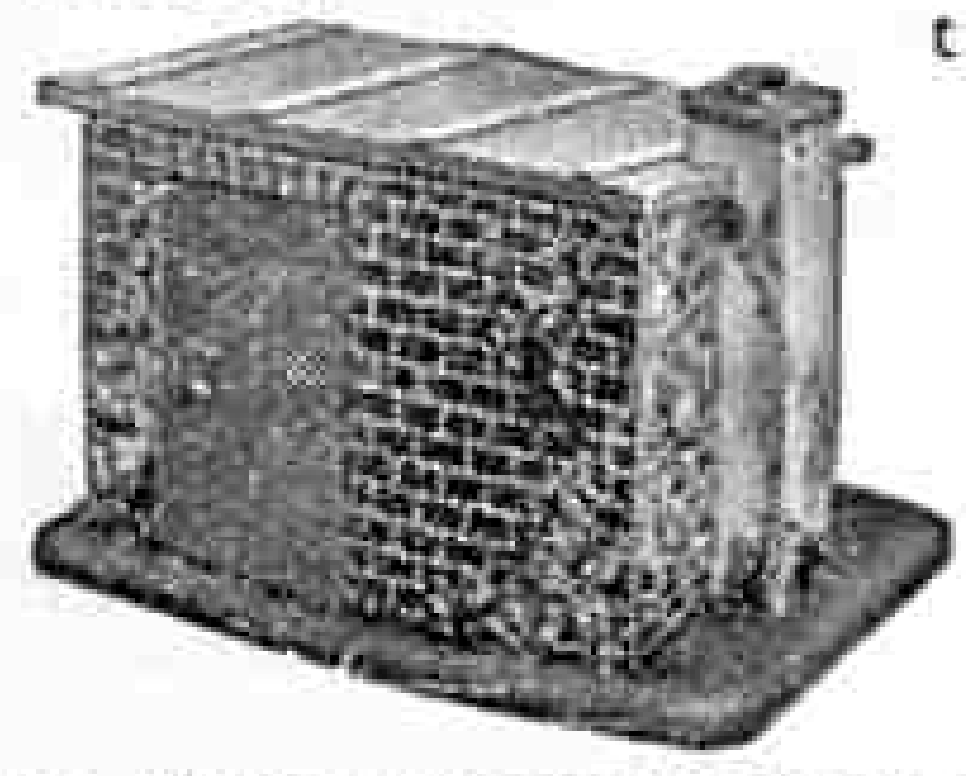
No. E2 LEVEL CROSSING (Electrical)
Similar to Level Crossing No. 2 excepting that a third rail is fitted in each of the two tracks.
Price 7/6



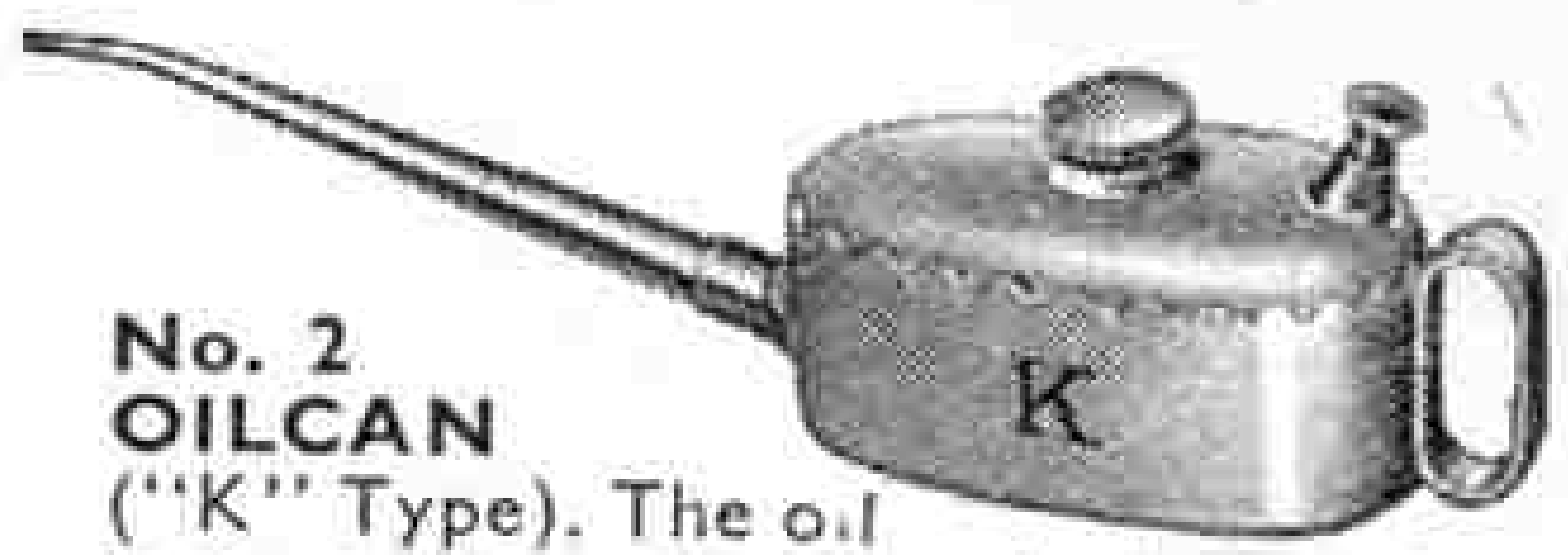
No. 1 BUFFER STOPS
(Spring type)
Price 1/-



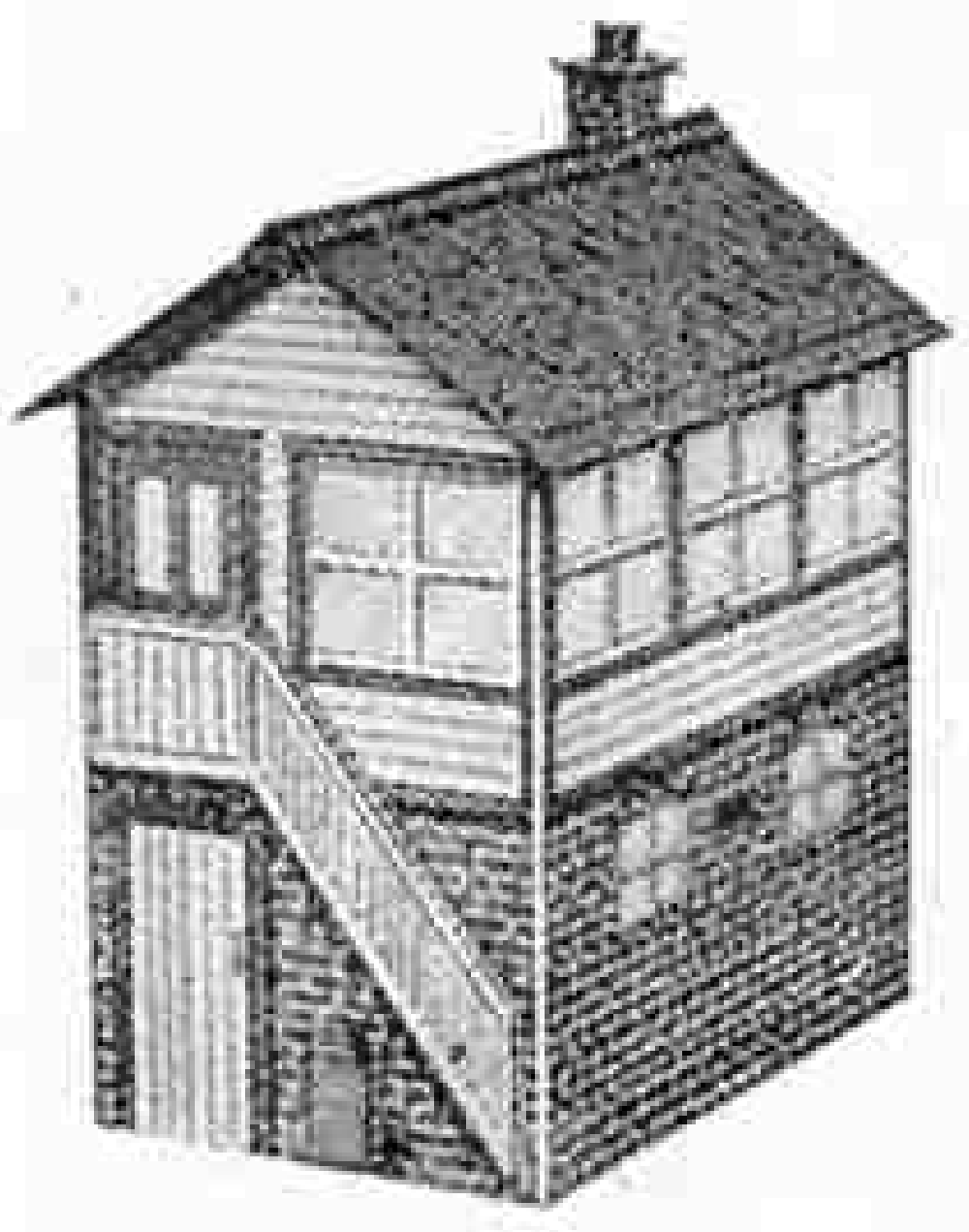
No. 1 OILCAN
Price 6d.



PLATELAYER'S HUT
Price 1/-

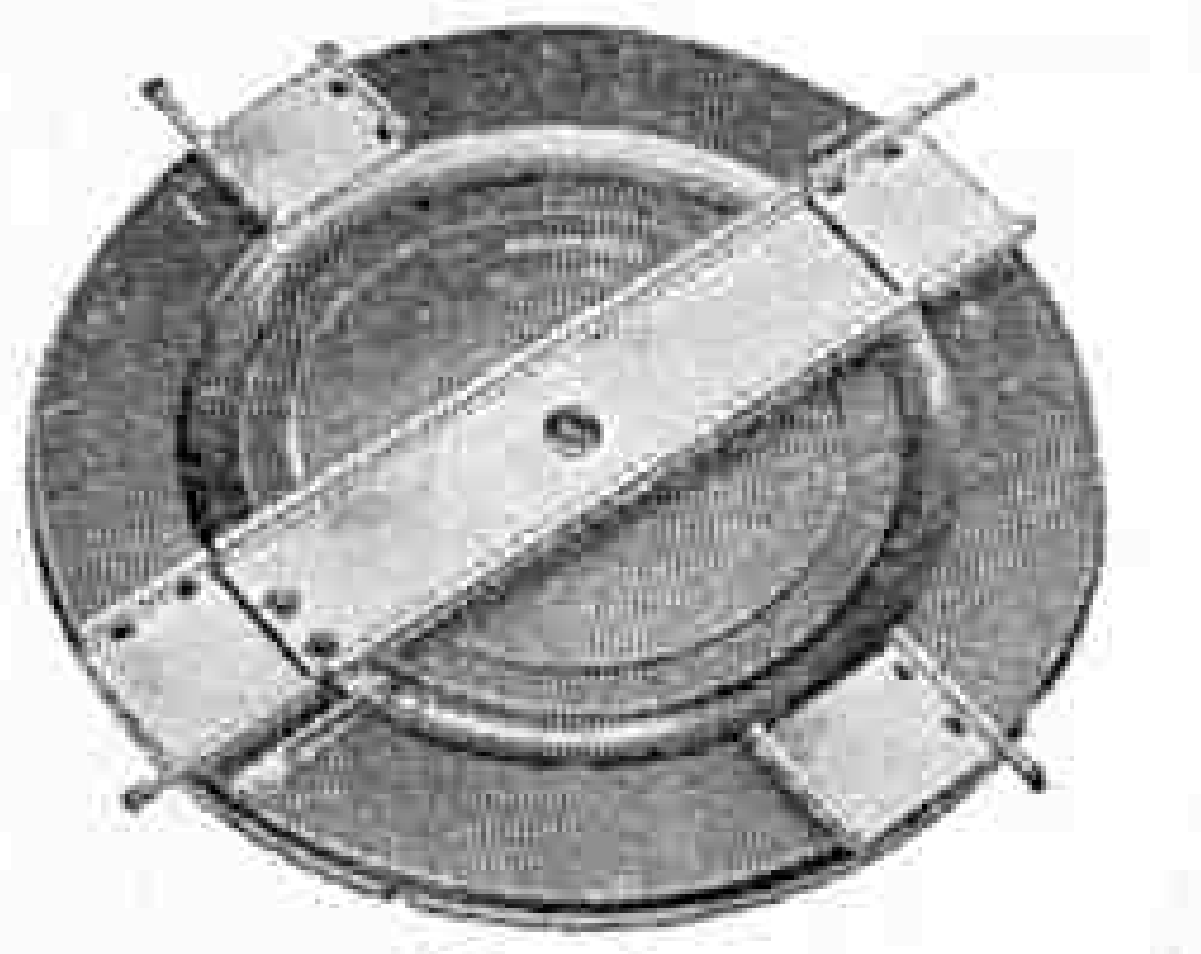


No. 2 OILCAN
("K" Type). The oil is ejected drop by drop by depressing the valve. Polished copper. Price 3/6

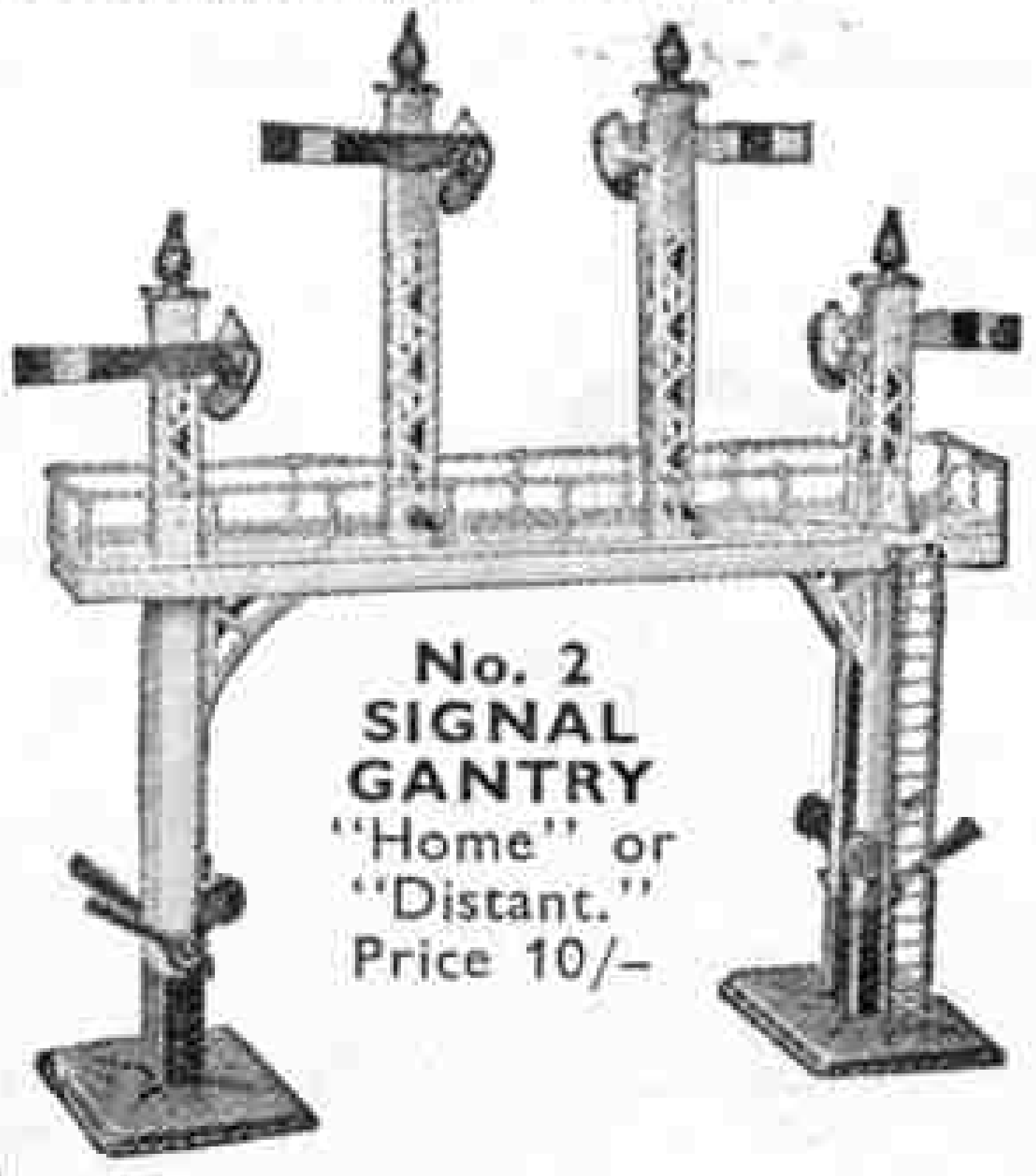


No. 1 SIGNAL CABIN
Finished in colours.
Price 2/6

No. 1 SIGNAL GANTRY
"Home" or "Distant."
Price 4/11

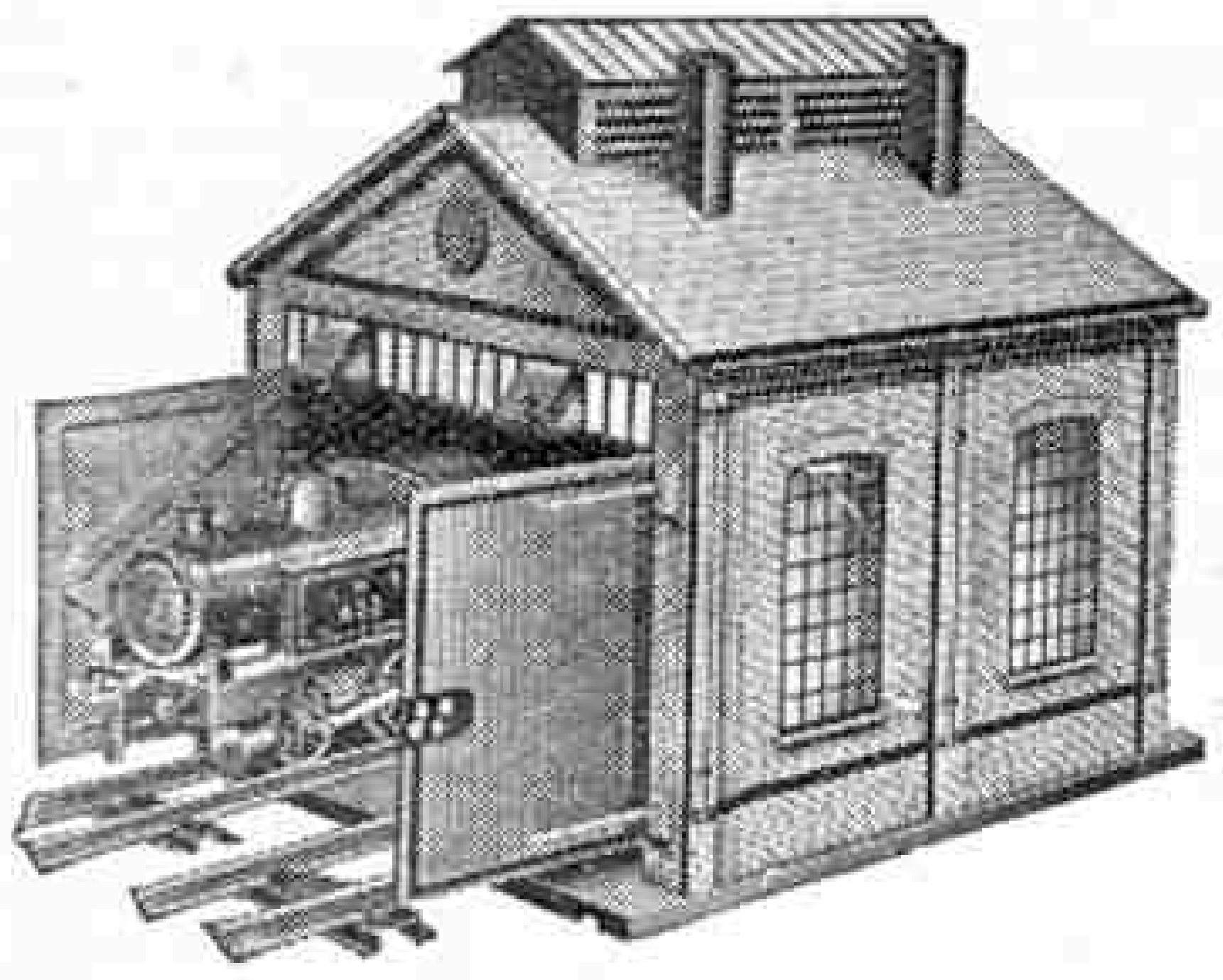


No. 1 TURNTABLE
Price 2/6

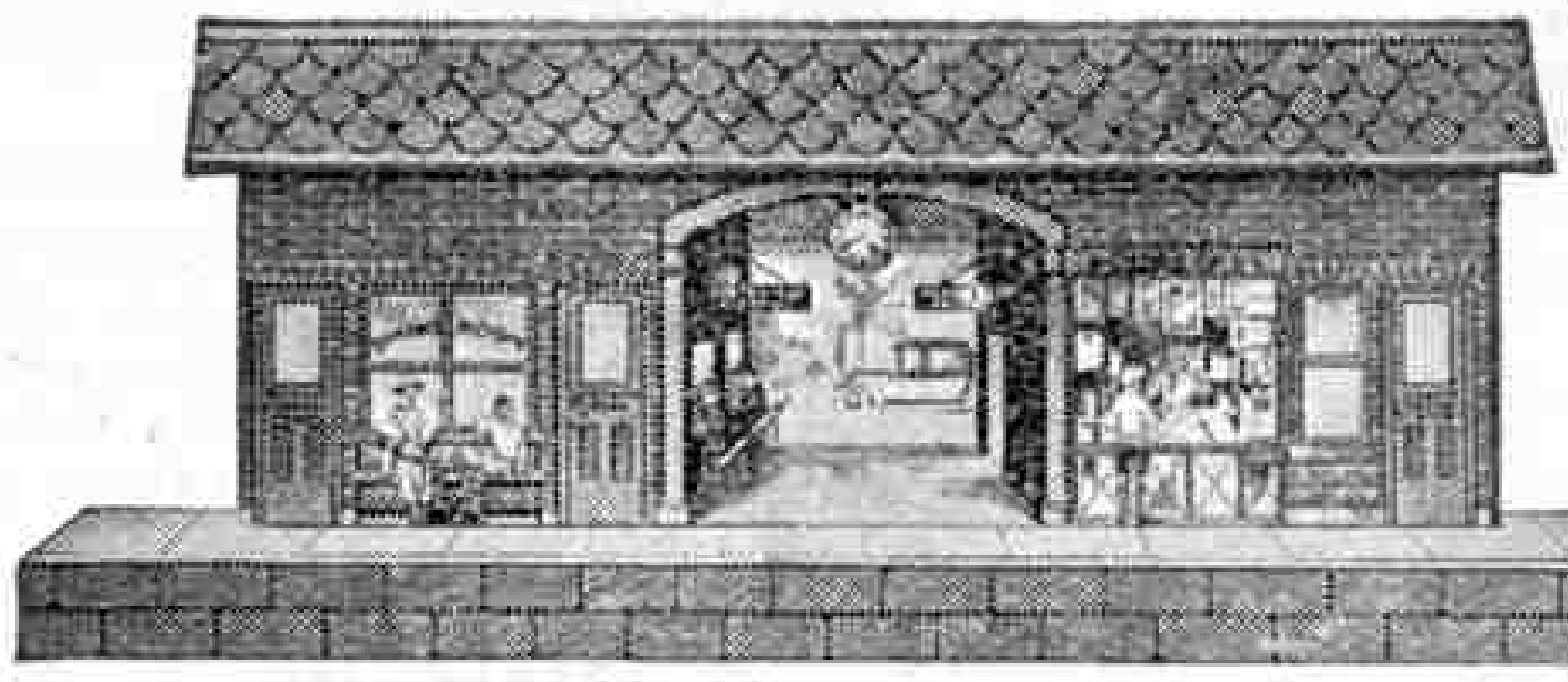


No. 2 SIGNAL GANTRY
"Home" or "Distant."
Price 10/-

No. 2 SIGNAL CABIN
Dimensions: Height 6½ in., width 3½ in., length 6½ in. Roof and back open to allow Lever Frame to be fitted inside cabin if desired. Price 3/9

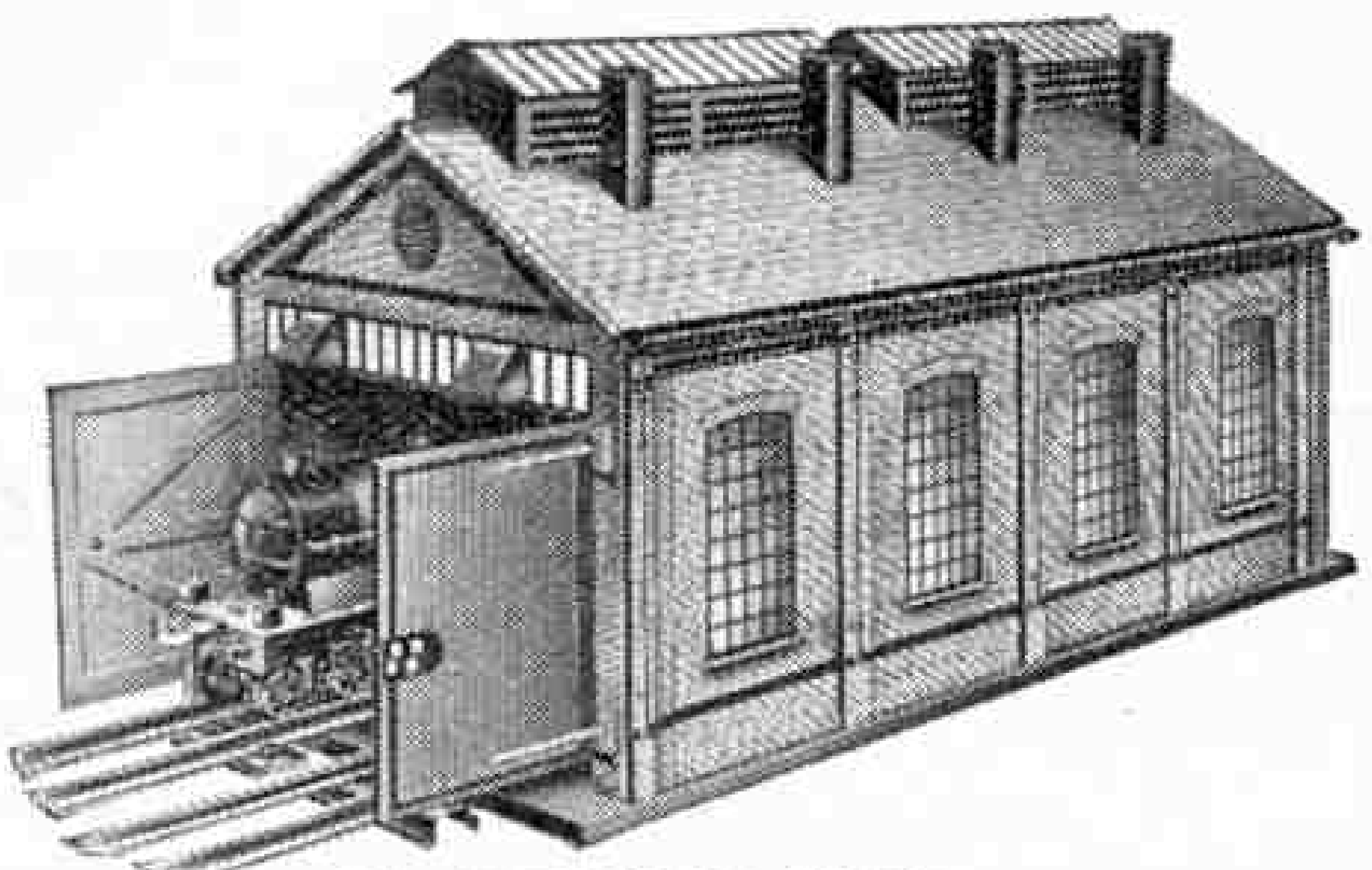


No. 1 ENGINE SHED
This Shed will accommodate any Locomotive and Tender with an overall length not exceeding 8¾ in. Price 15/-



No. 1 STATION
Length 16¾ in., width 6 in., height 6 in. Price 4/6

VIADUCT Price 6/6 **VIADUCT (Electrical)** Price 7/6
VIADUCT Centre Section only... ... ... Price 4/-
VIADUCT (Electrical) Centre Section only... ... Price 4/6



No. 2 ENGINE SHED
This Shed will accommodate any Locomotive and Tender with an overall length not exceeding 17½ in.
Price 22/6

MECCANO LIMITED – BINNS ROAD – LIVERPOOL 13

Do YOU know
a better oil than
WAKEFIELD
Patent Castrol

"The Autocar" Drawing.

Sir Malcolm Campbell
doesn't

—neither does the motorist interested in a modest thirty. To him Patent Castrol has the added advantage that, thanks to its patented chromium and tin content, it reduces cylinder wear and keeps down his oil consumption.

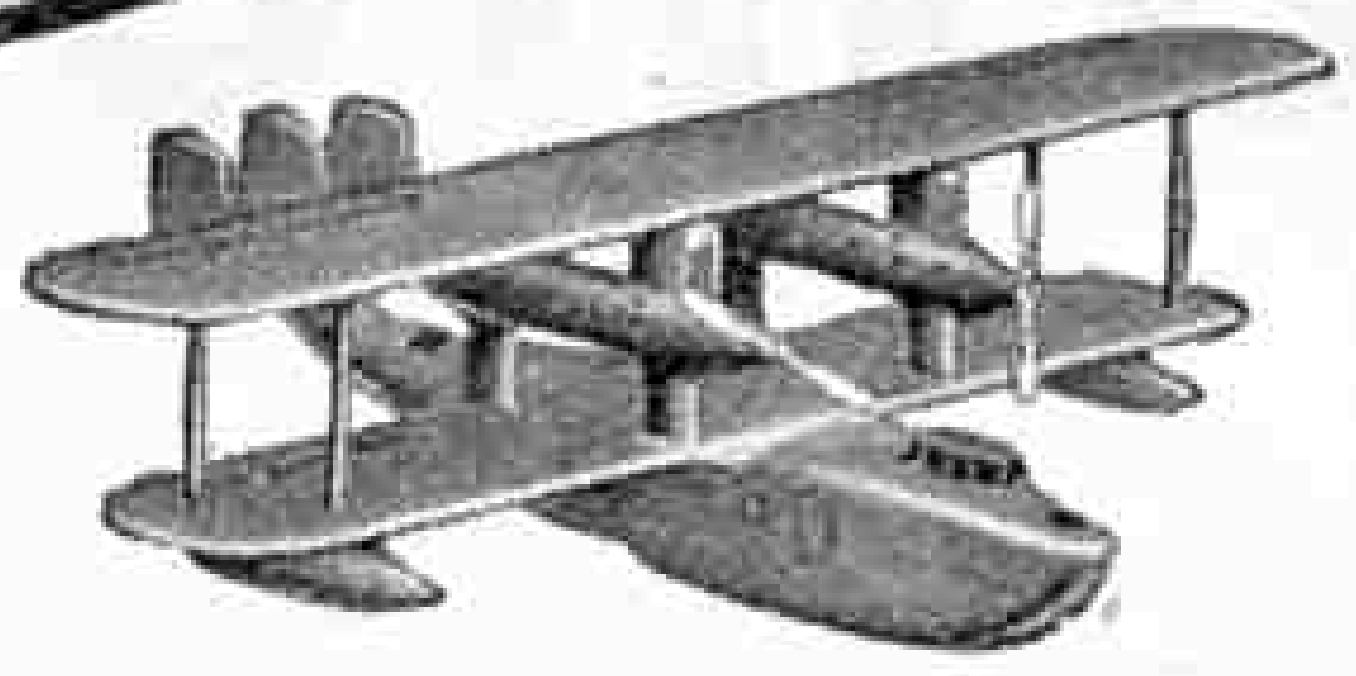
C. C. WAKEFIELD & CO. LTD., All-British Firm, Wakefield House, Cheapside, London, E.C.2

TOYS OF QUALITY MADE BY MECCANO LTD

DINKY TOYS

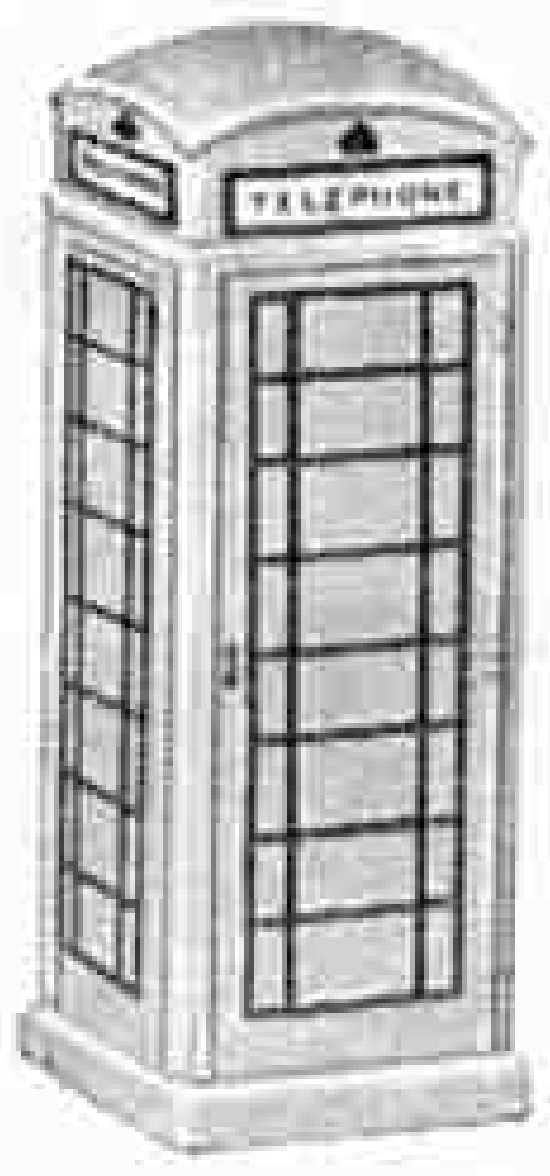
200 VARIETIES

CARAVAN TRAILER
Dinky Toys No. 30g
For use with the Saloon Cars in Dinky Toys Nos. 24 and 30. Assorted colours. Fitted with detachable rubber tyres. Price 6d. each

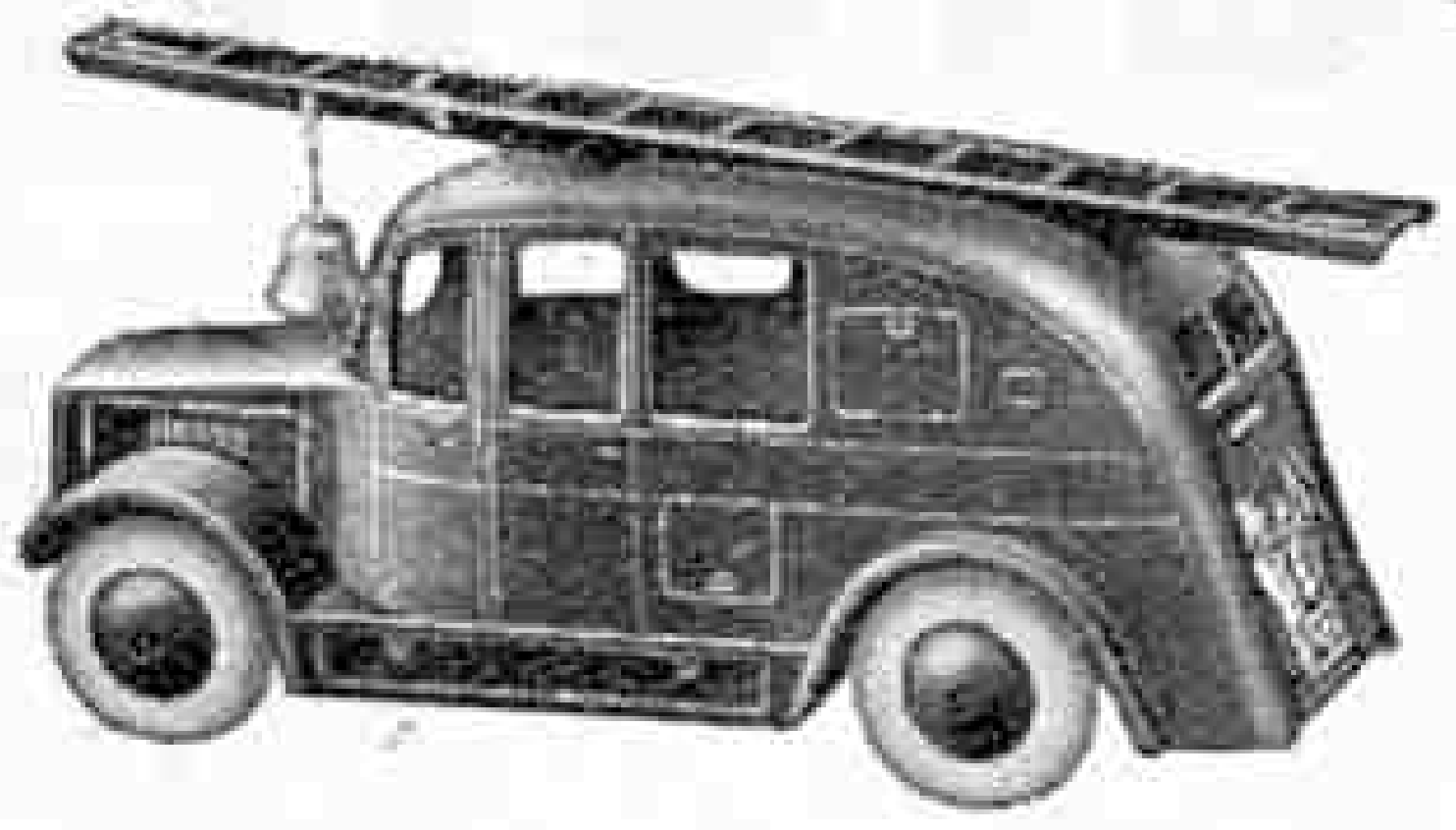


SINGAPORE III FLYING BOAT
Dinky Toys No. 60h
Price 1/– each

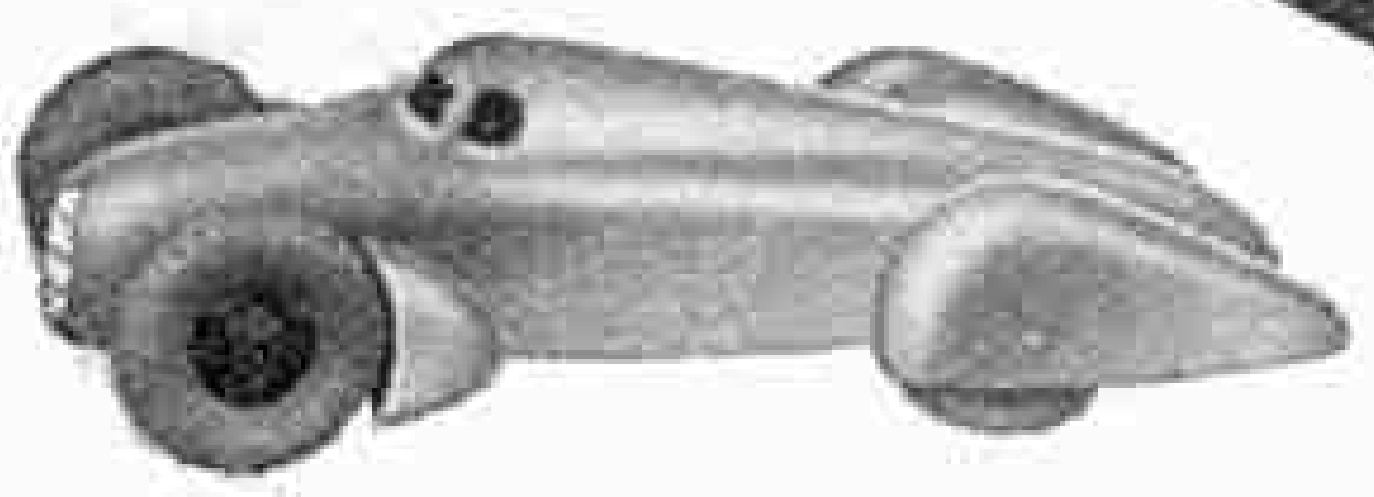
FOUR-ENGINE FLYING BOAT
Dinky Toys No. 60m
Similar in type to No. 60h. Assorted colours. Fitted with rollers. Price 1/– each



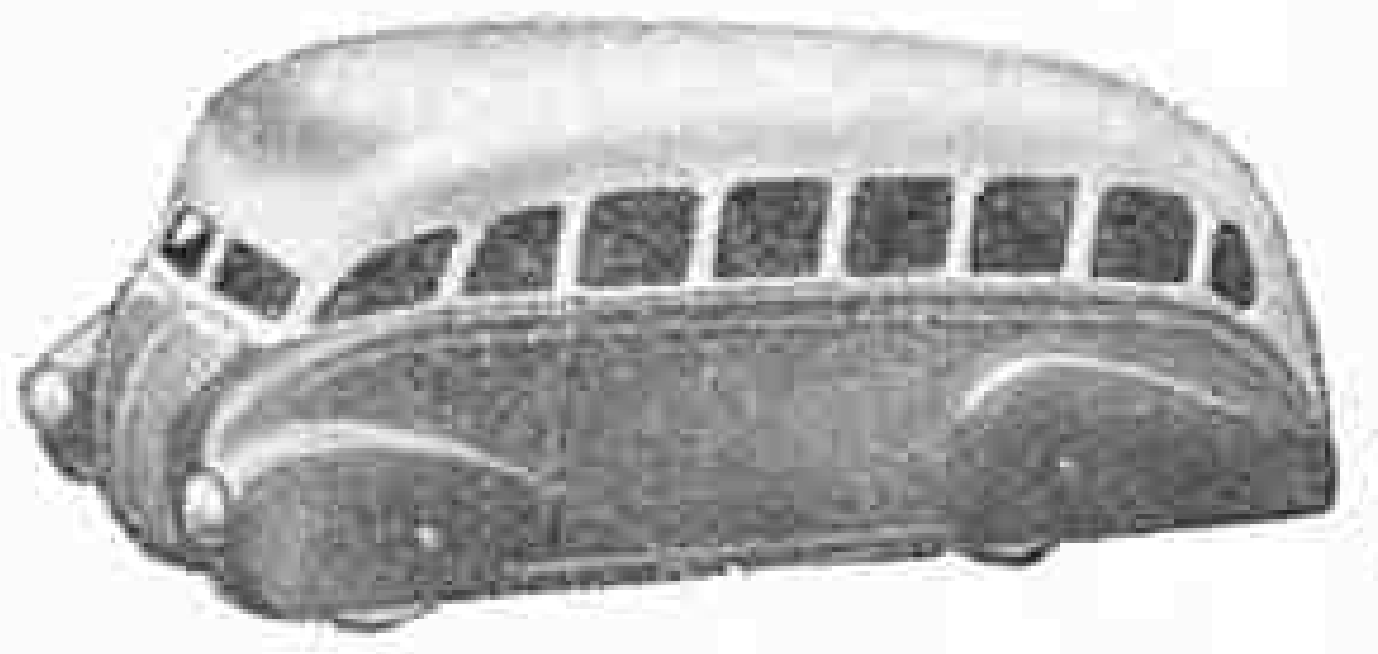
TELEPHONE CALL BOX
Dinky Toys No. 12c
Price 4d. each



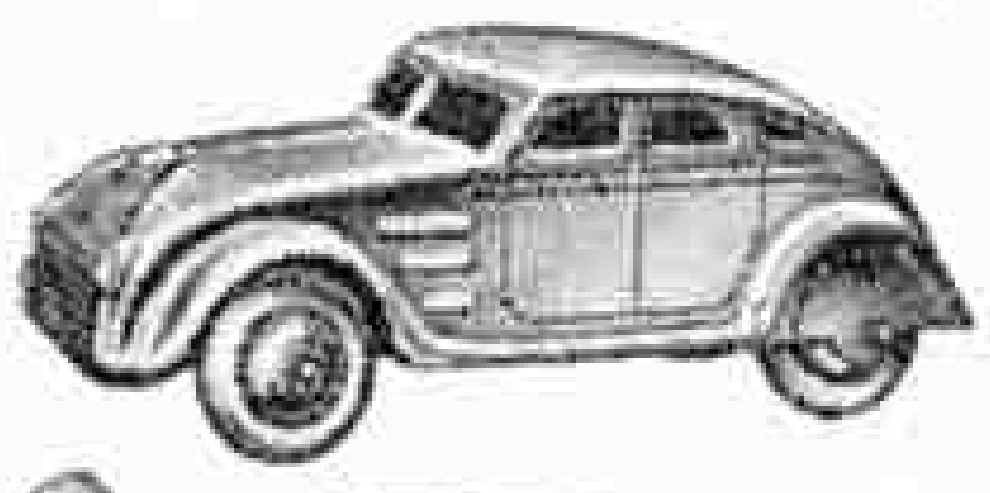
STREAMLINE FIRE ENGINE
Dinky Toys No. 25h
Fitted with detachable rubber tyres. Price 9d. each



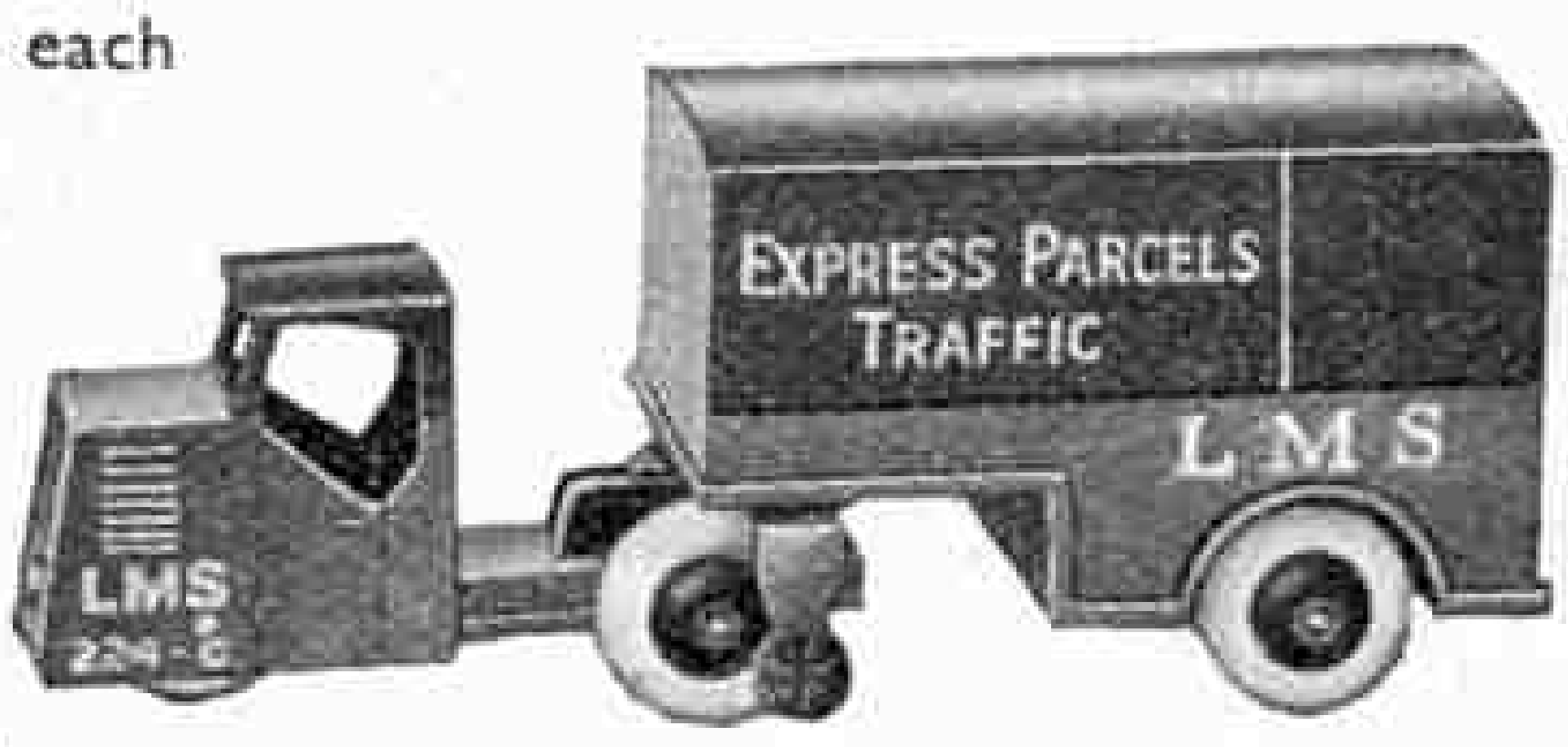
AUTO-UNION RACING CAR
Dinky Toys No. 23d
Assorted colours. Fitted with detachable rubber tyres.
Price 7d. each



STREAMLINE BUS
Dinky Toys No. 29b
Fitted with rubber tyres.
Price 6d. each

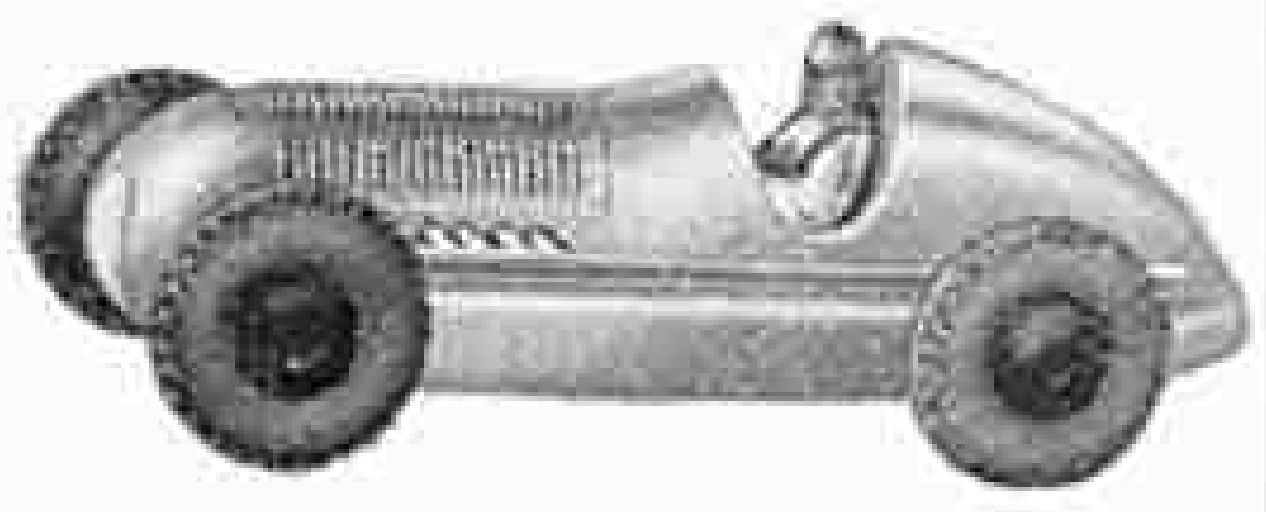


STREAMLINE SALOON
Dinky Toys No. 22h
Assorted colours. Fitted with detachable rubber tyres and silver-plated radiator.
Price 6d. each

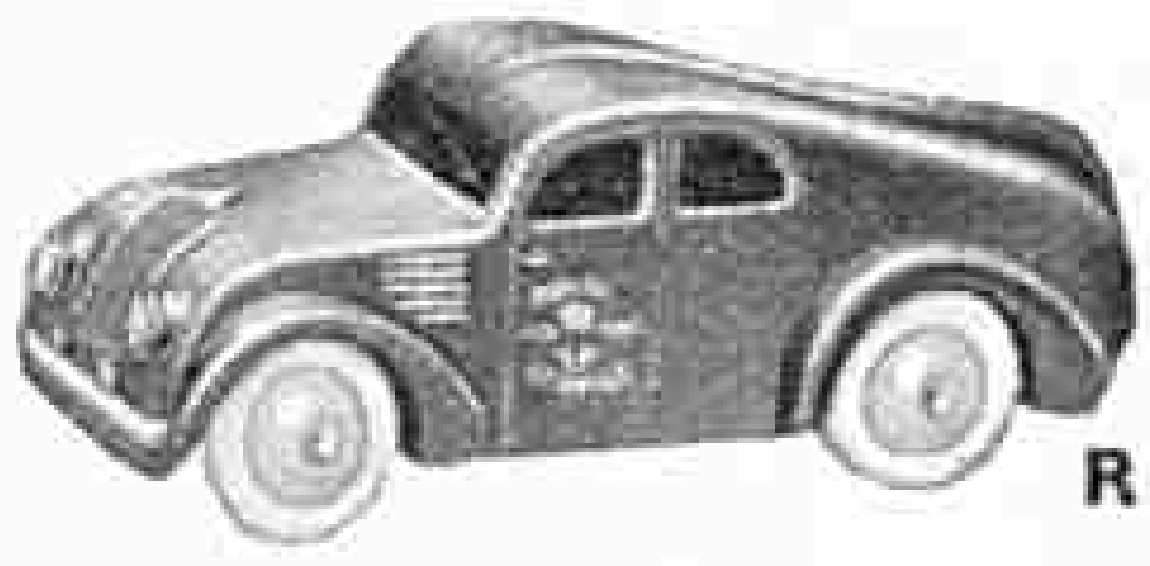


RAILWAY MECHANICAL HORSE AND TRAILER VAN
Dinky Toys No. 33R
Fitted with detachable rubber tyres. Price complete, L.M.S.R., L.N.E.R., G.W.R. or S.R., 1/6

D.H. "COMET" AEROPLANE
Dinky Toys No. 60g
Scale model of plane used by C. W. A. Scott and T. C. Black in their Australian flight.
Price 6d. each



MERCEDES-BENZ RACING CAR
Dinky Toys No. 23c
Assorted colours. Fitted with detachable rubber racing tyres. Price 8d. each

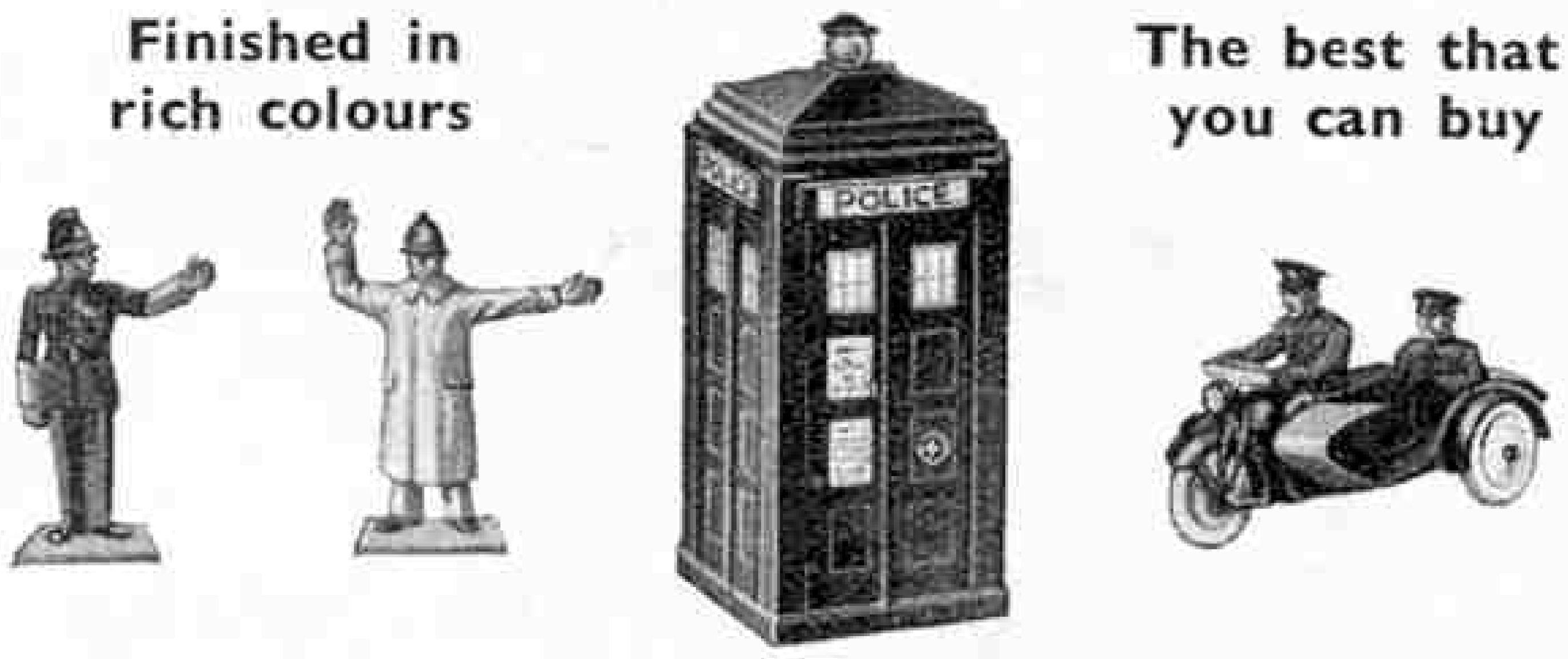


ROYAL AIR MAIL SERVICE CAR
Dinky Toys No. 34
In correct colours. Fitted with detachable rubber tyres. Price 6d. each

ROBOT TRAFFIC SIGNAL
Dinky Toys No. 47a
(Four-face)
Price 3d. each

ROBOT TRAFFIC SIGNAL
Dinky Toys No. 47b
(Three-face)
Price 3d. each

ROBOT TRAFFIC SIGNAL
Dinky Toys No. 47c
(Two-face)
Right-angle or Back-to-back.
Price 3d. each



Finished in rich colours

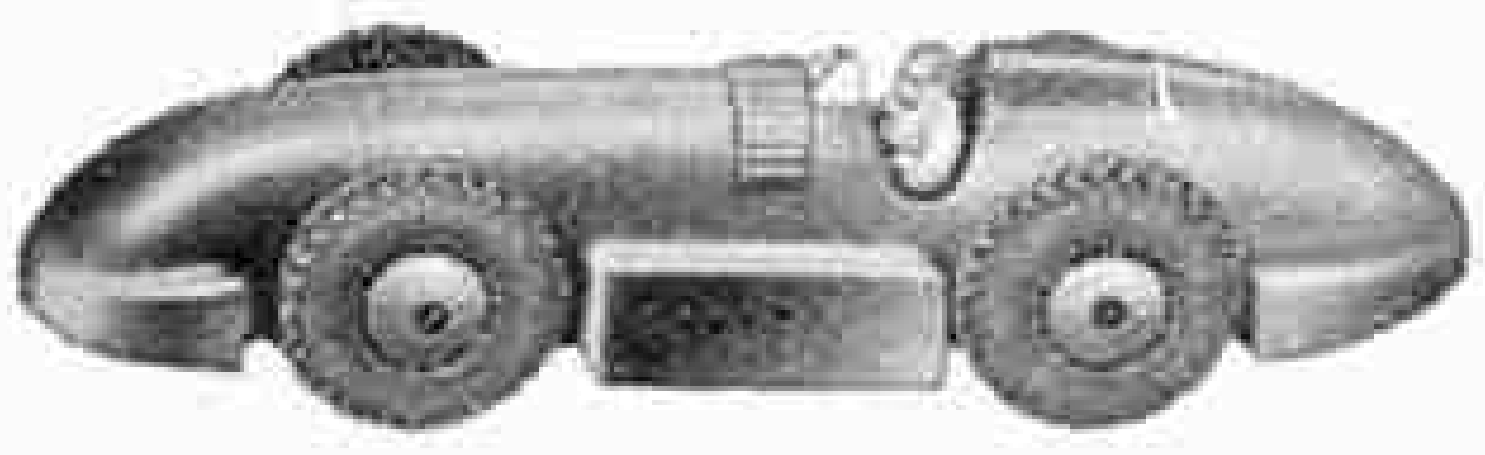
The best that you can buy

POLICE HUT, MOTOR CYCLE PATROL AND POLICEMEN
Dinky Toys No. 42

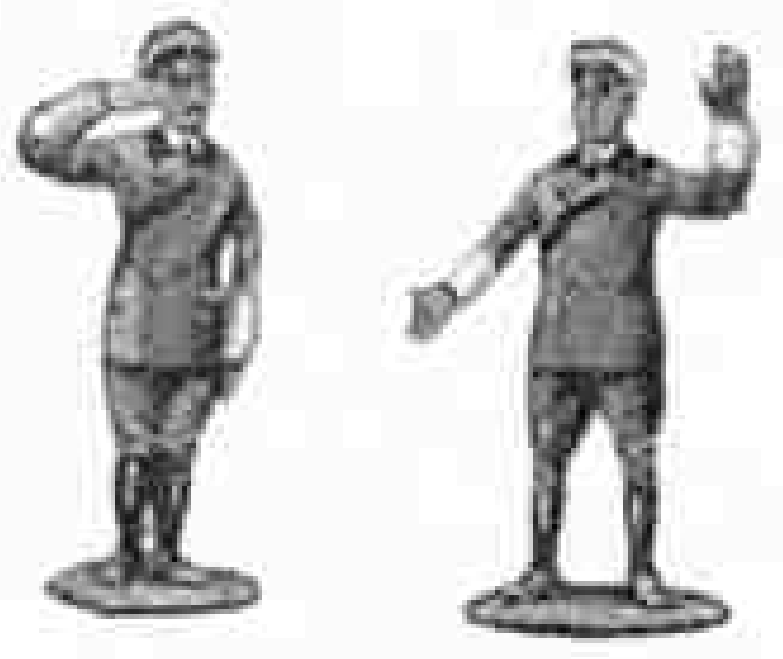
No. 42a	Police Hut	... each 6d.
No. 42b	Motor Cycle Patrol	... ,, 10d.
No. 42c	Point Duty Policeman (in White Coat)	... ,, 3d.
No. 42d	Point Duty Policeman	... ,, 4d.

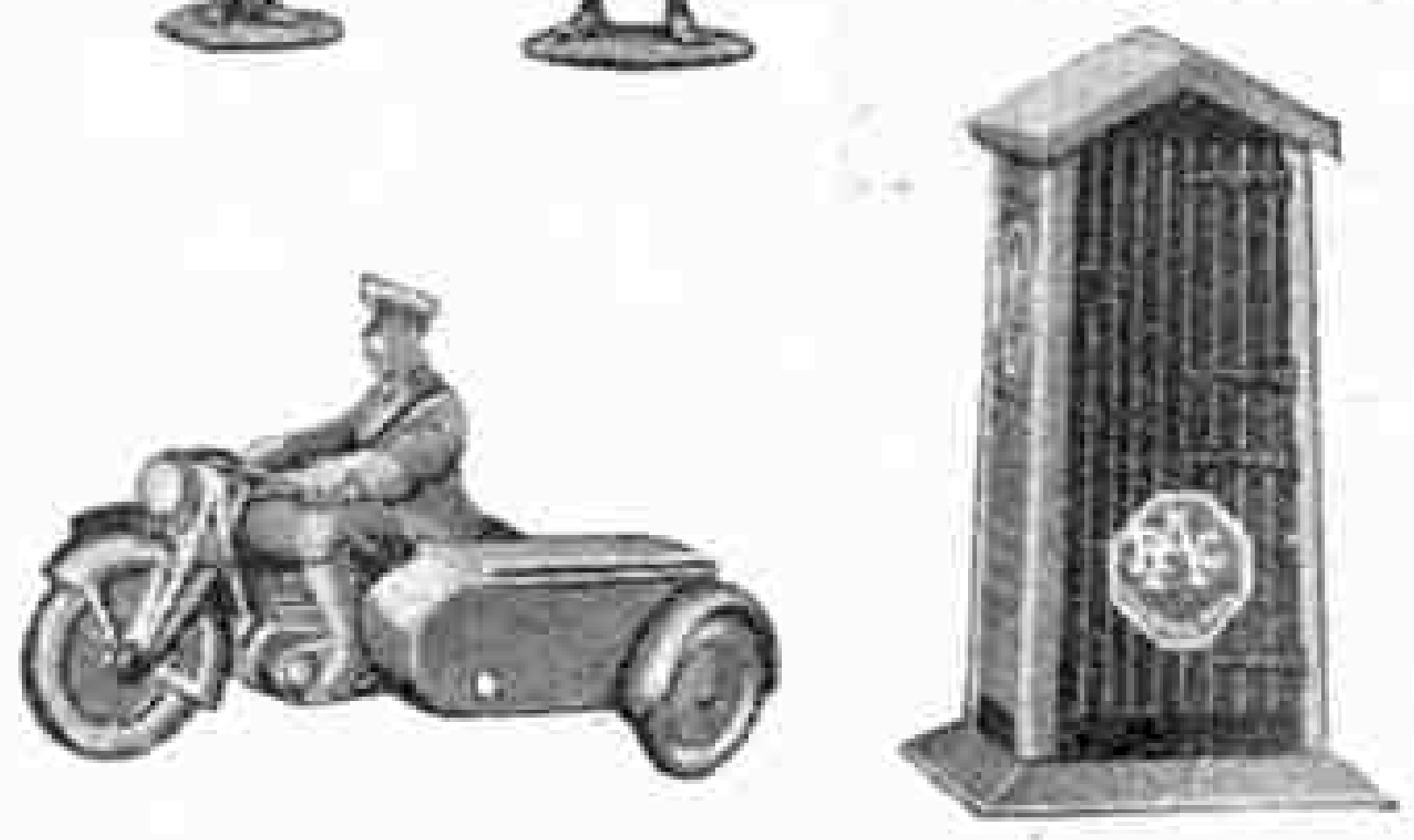
Price of complete set 1/11

BEACON
Dinky Toy No. 47d
(Realistic models of the Belisha Safety Beacons.)
Price 1d. each



"SPEED OF THE WIND" RACING CAR
Dinky Toys No. 23e
Assorted colours. Fitted with detachable rubber racing tyres.
Price 8d. each

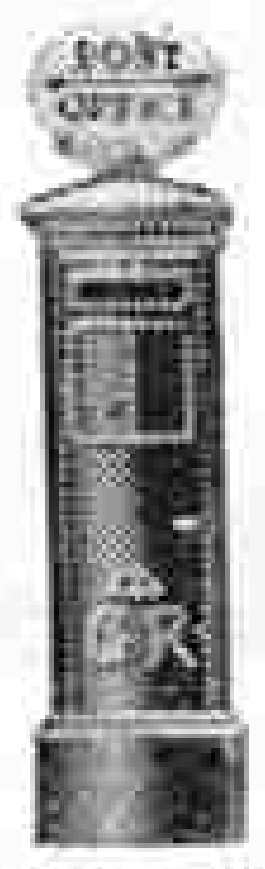




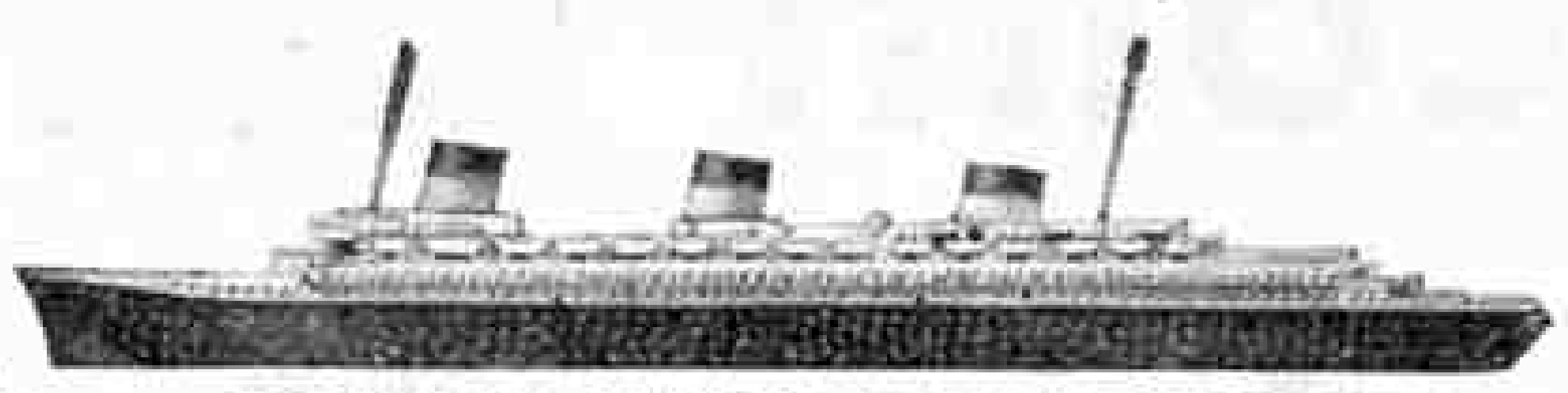
R.A.C. HUT, MOTOR CYCLE PATROL AND GUIDES
Dinky Toys No. 43
This set is representative of the familiar personnel and road hut of the R.A.C. Each item is finished in correct colours.

No. 43a	R.A.C. Hut	... each 6d.
No. 43b	R.A.C. Motor Cycle Patrol ...	,, 9d.
No. 43c	R.A.C. Guide directing traffic ...	,, 3d.
No. 43d	R.A.C. Guide at the salute ...	,, 3d.

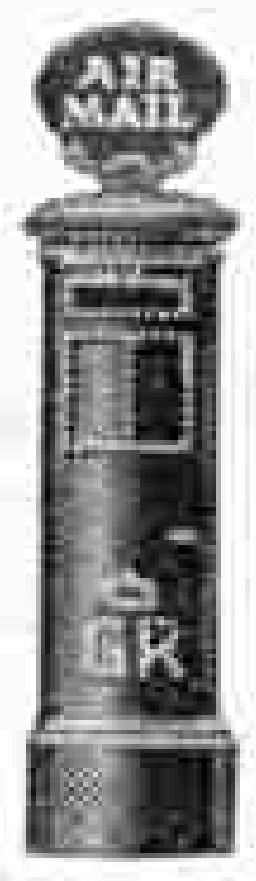
Price of complete set 1/9



PILLAR LETTER BOX G.P.O.
Dinky Toys No. 12a
Price 3d. each



FRENCH LINER "NORMANDIE"
Meccano Dinky Toys No. 52c
A model of the French Line's giant steamship "Normandie." Made in France by Meccano (France) Ltd. Price 1/6 each

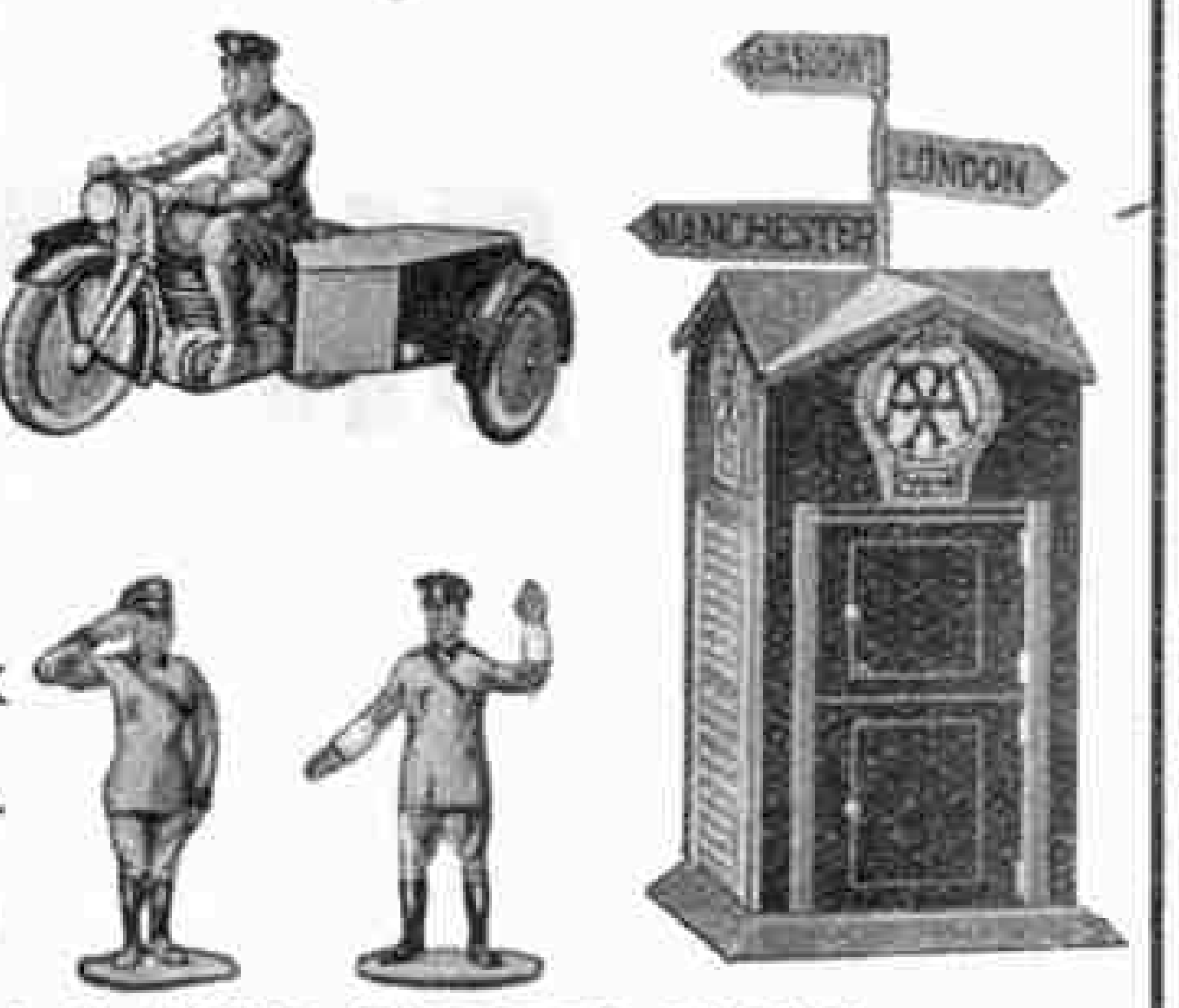


PILLAR LETTER BOX AIR MAIL
Dinky Toys No. 12b
Price 3d. each

SMALL CARS
Dinky Toys No. 35

No. 35a	Saloon Car	... each 3d.
No. 35b	Racer	... ,, 3d.
No. 35c	"M.G." Sports Car	... ,, 3d.

Price of complete set 9d.



A.A. HUT, MOTOR CYCLE PATROL AND GUIDES
Dinky Toys No. 44
Collectors of Dinky Toys will find this new addition to the range of particular interest. Each item is finished in correct colours.

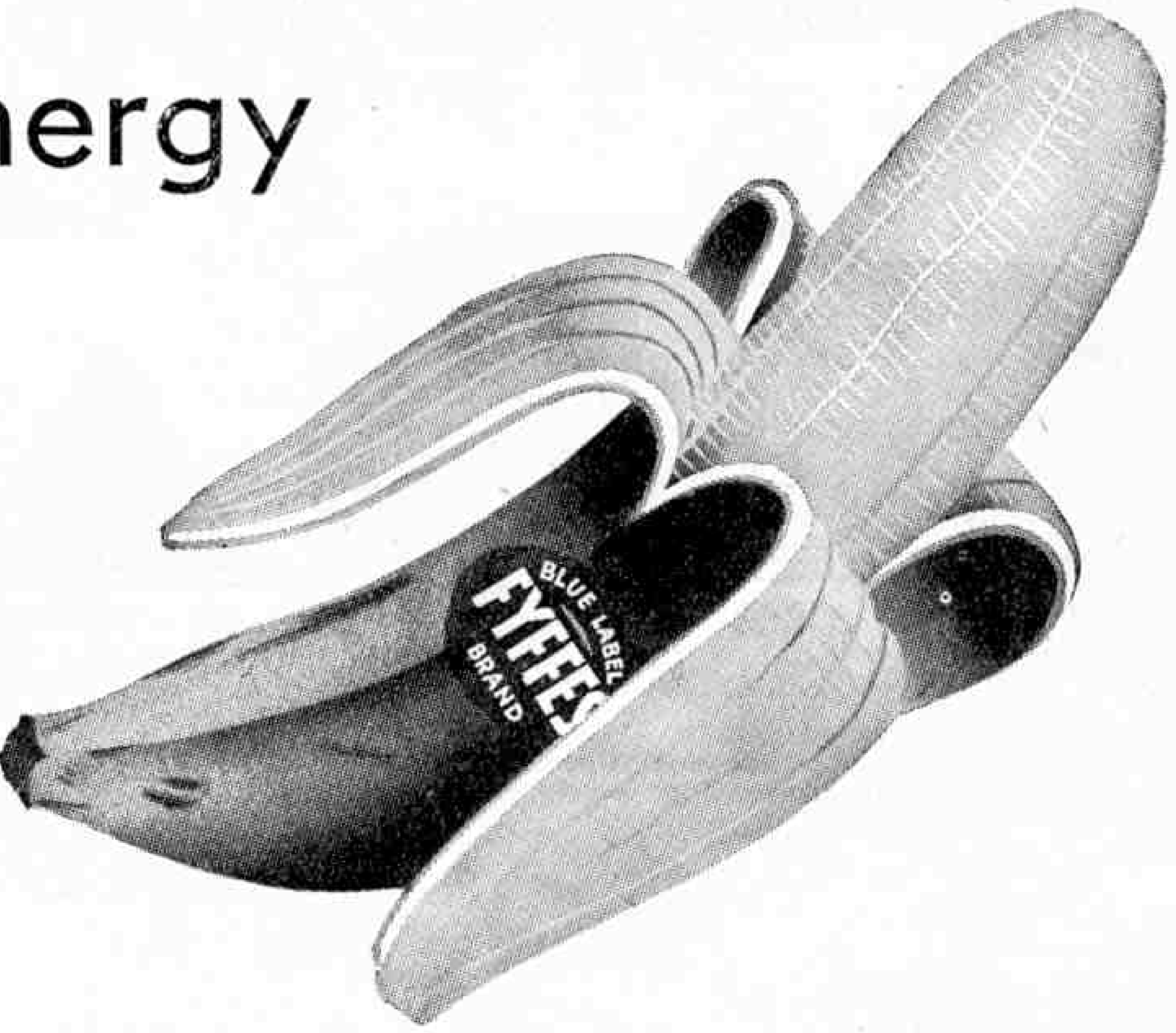
No. 44a	A.A. Hut	... each 8d.
No. 44b	A.A. Motor Cycle Patrol ...	,, 9d.
No. 44c	A.A. Guide directing traffic ...	,, 3d.
No. 44d	A.A. Guide at the salute ...	,, 3d.

Price of complete set 1/11

MECCANO LTD. : : BINNS ROAD : : LIVERPOOL 13

Have a banana

the fruit for energy



Have a banana when you're feeling tired. There's no quicker and healthier way of restoring your vitality. For ripe bananas are rich in natural glucose—that wonderful fruit sugar which turns itself into energy in the body—*at once.* And what delicious fruit! So good for you. No trouble to eat. And such good value for money.

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JIFFY "KODAK" V.P.

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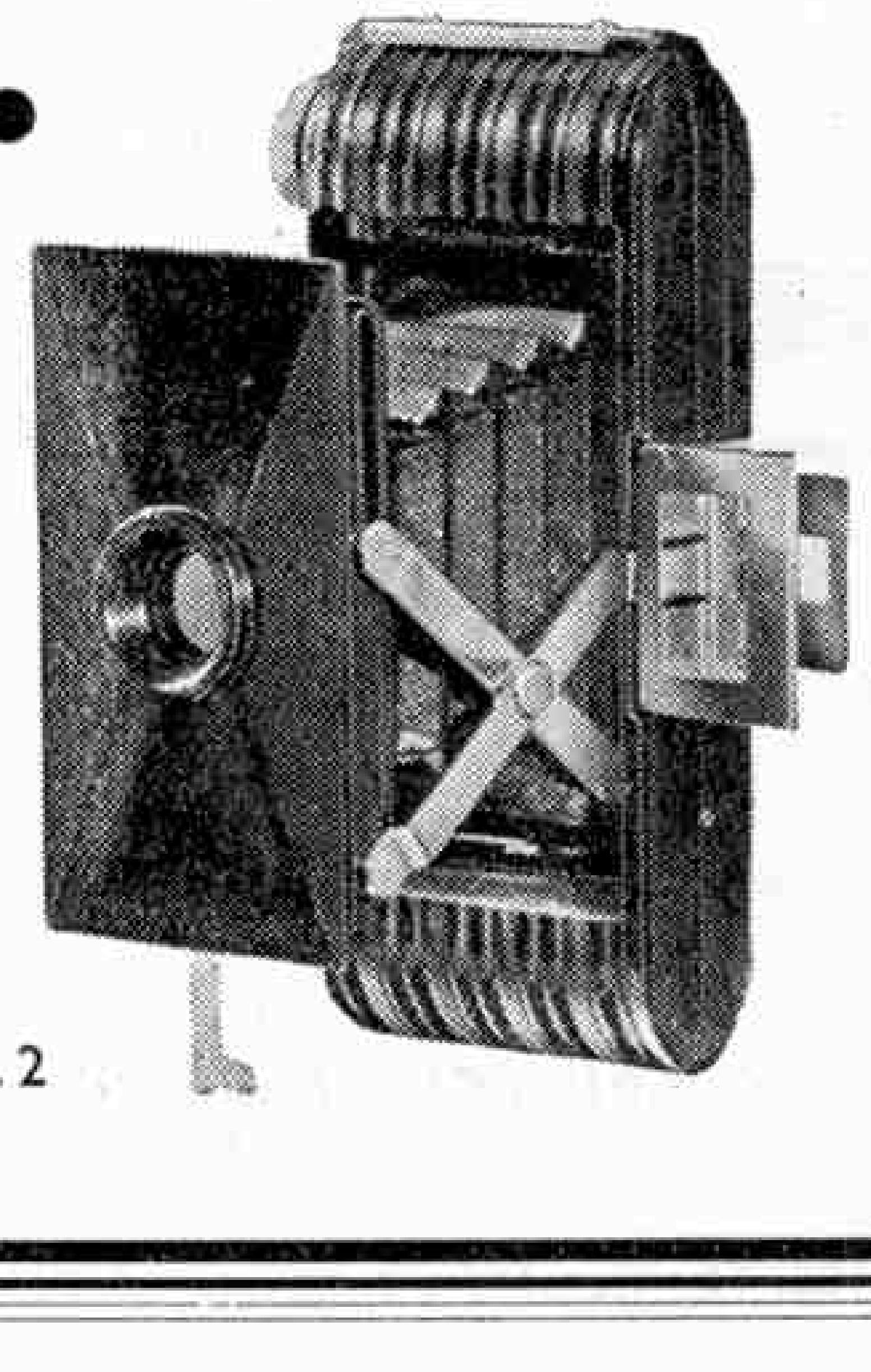

Small, light and very smart. Opens itself at the touch of a button. Fitted with fixed focus Kodak Doublet lens; shutter for Snapshot and Time exposures; eye-level viewfinder. Takes eight snaps 2½″ x 1⅝″ on a roll of V.P. Kodak Film.

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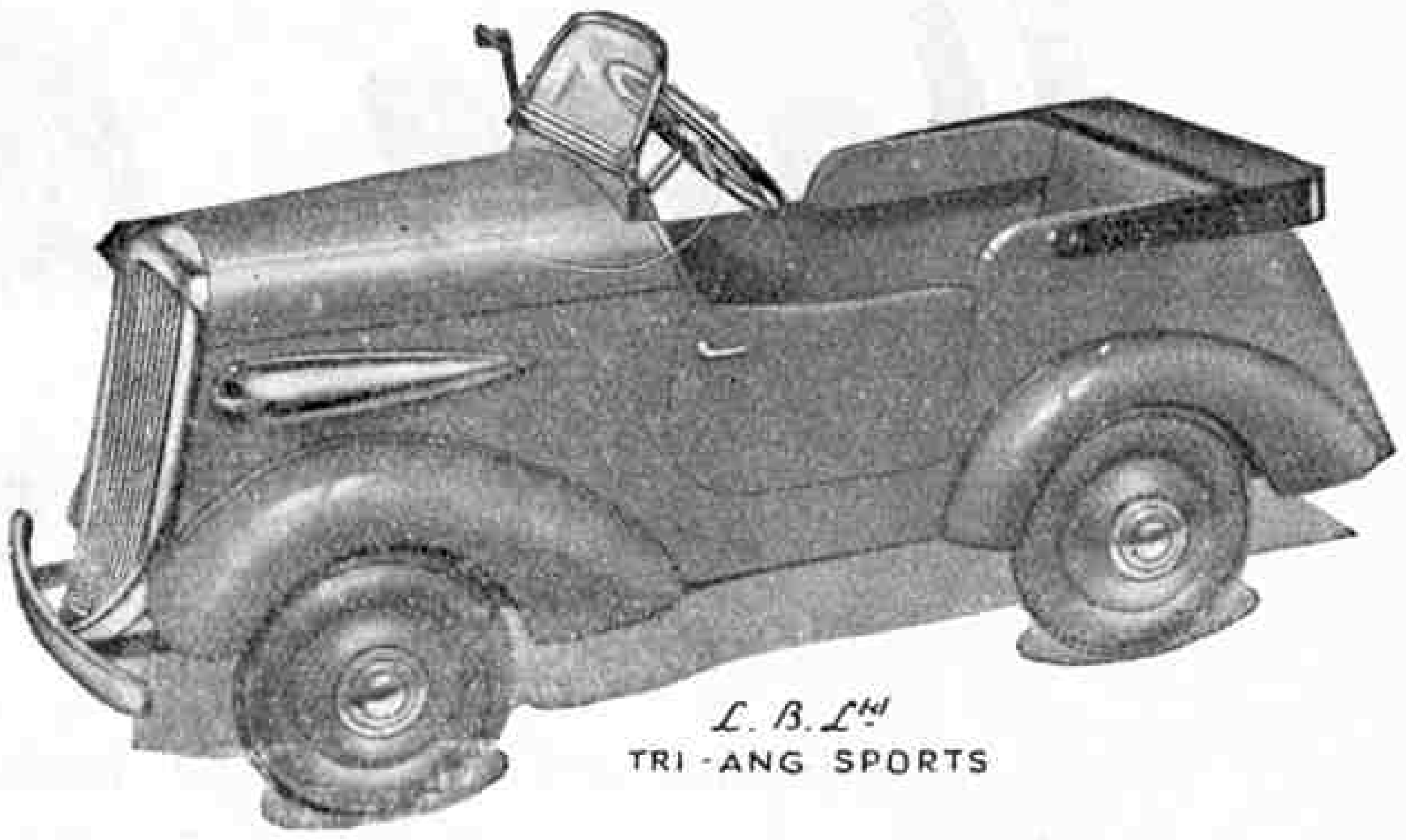
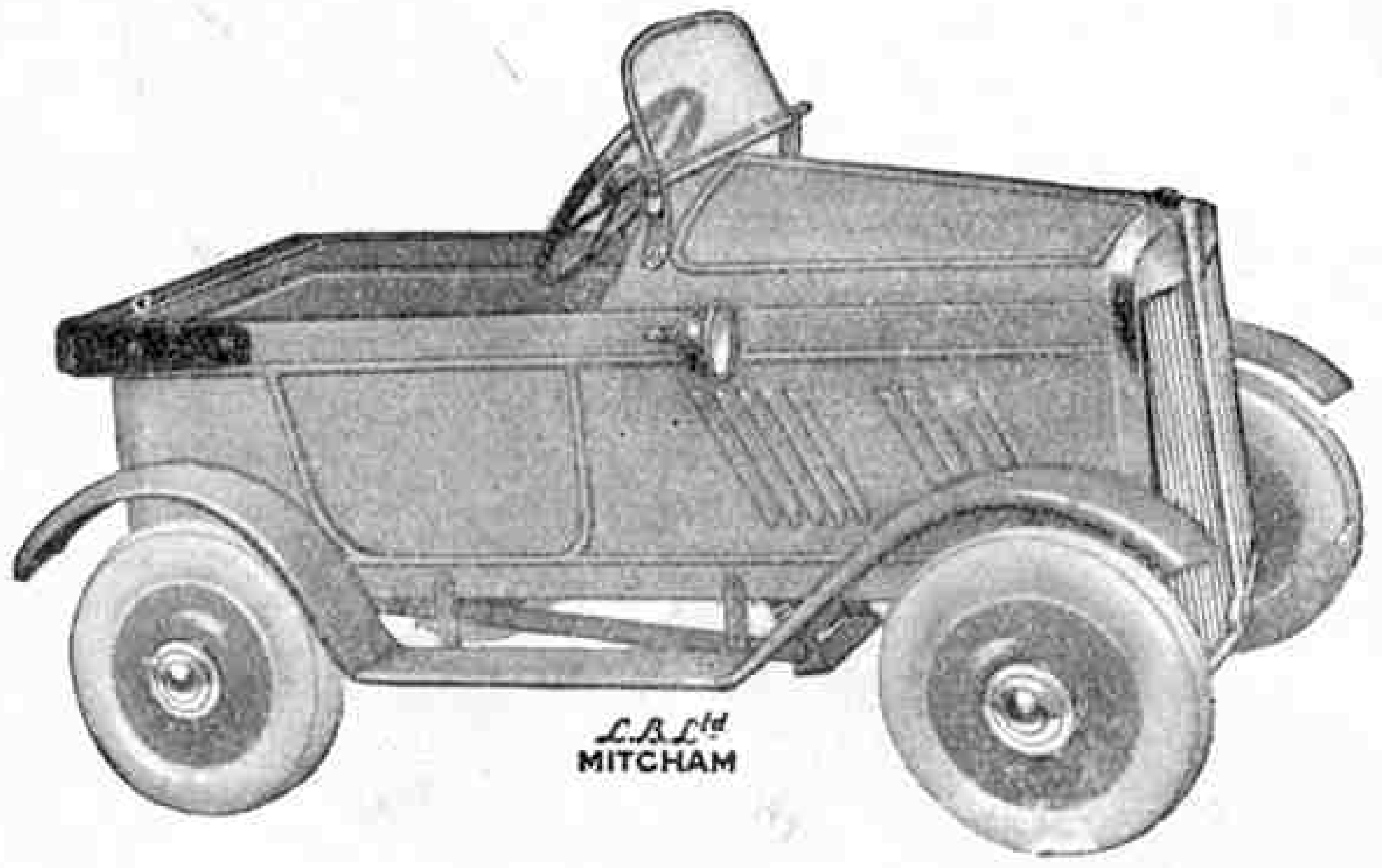
TRI-ANG

MODERN CARS FOR MODERN BOYS

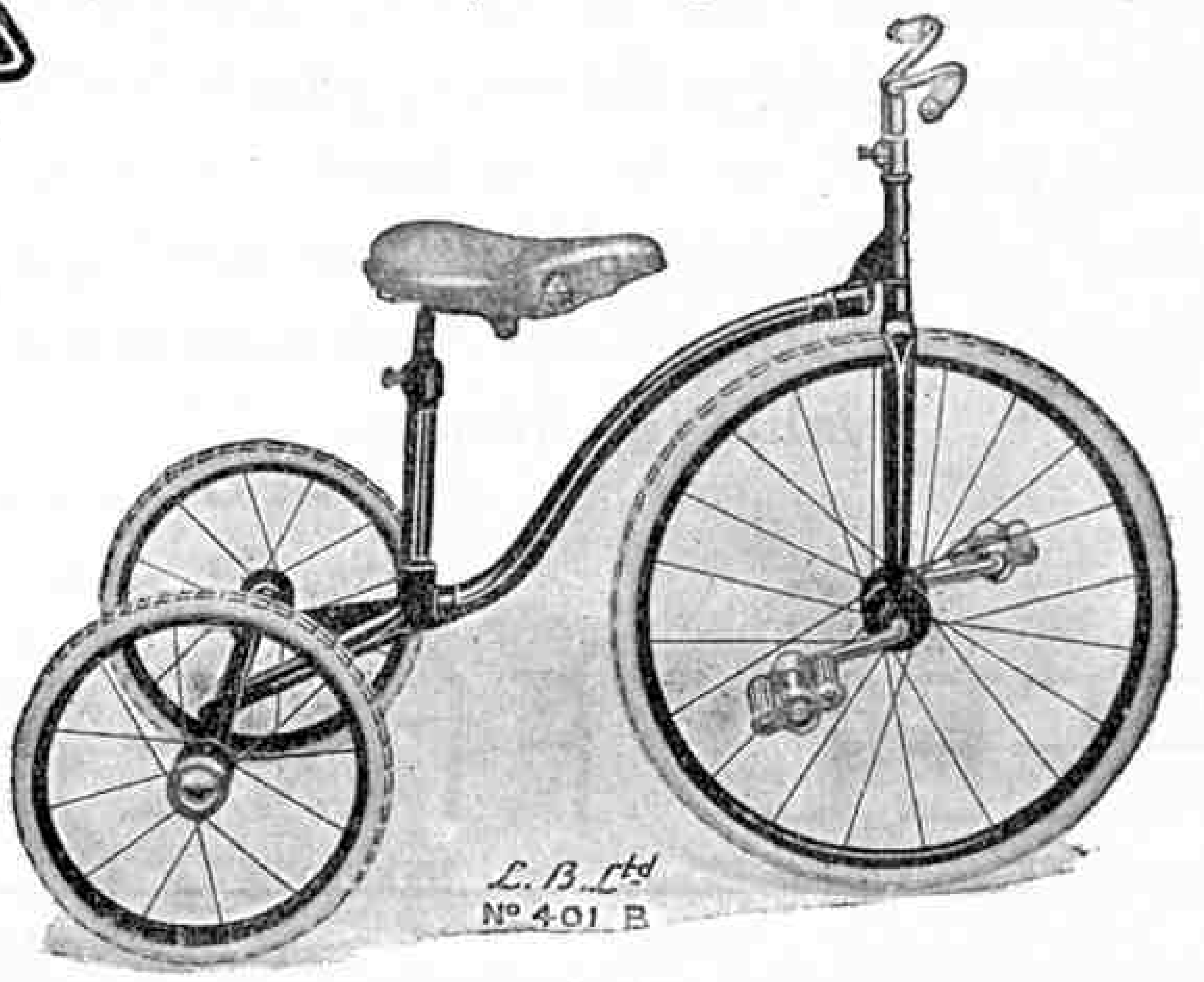


TRI-ANG SPORTS
Entirely new streamline model. All steel body, with luggage boot and opening side door. 8 in. balloon disc wheels, ½ in. rubber tyres. Plated bumper and streamline dummy side lamps. Windscreen, direction indicator and dummy hood. Length 41 in



L. BROS. LTD. LONDON
L BROS
ENGLAND
REGD. TRADE MARK

MITCHAM
Pressed steel body. Magna type radiator. Windscreen and direction indicator. Dummy hood and lamps. 8 in. balloon disc wheels, ½ in. rubber tyres. Length 32 in.



TRI-ANG JUNIOR TRIKE No. 401B
Strong cycle tube frames. Enamelled black. Gold lines. Adjustable saddle. Thick white auto tread tyres. Nickel plated fittings.

TRI-ANG "FAIRYCYCLE" (Regd.) MODEL No. 2
Tubular frame. 14 in. wheels. 1¼ in. grey imitation pneumatic tyres. Ball bearing pedals. Rim brake. Two coil saddle. Chain cover. Stand. CHROMIUM-PLATED FITTINGS. Black, blue or maroon.

TRI-ANG TRIKE No. 51
New model, best quality frame. Free wheel. Rim brake. Chain guard. 1¼ in. imitation pneumatic tyres. Front wheel 12 in. dia.; back wheels, 14 in. dia. All bright parts Chromium plated. Remarkable value. Black, blue or maroon.

OBTAINABLE AT ALL GOOD TOY SHOPS AND STORES

TRI-ANG TRICYCLE No. 5 (Regd. Trade Mark)
FITTED WITH REAR MUDGUARDS. Cycle chain drive with free-wheel. Frame best quality weldless cycle tubing. 14 in. wheels. 1¼ in. jointless sponge-rubber tyres. Rimbrake. Coil-spring saddle. CHROMIUM FITTINGS. Black or blue.

Made by
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NEXT MONTH: "STORY OF THE TRAMCAR." PUBLISHING DATE: 1st JULY

MECCANO MAGAZINE

Editorial Office:
Binns Road, Liverpool 13
England

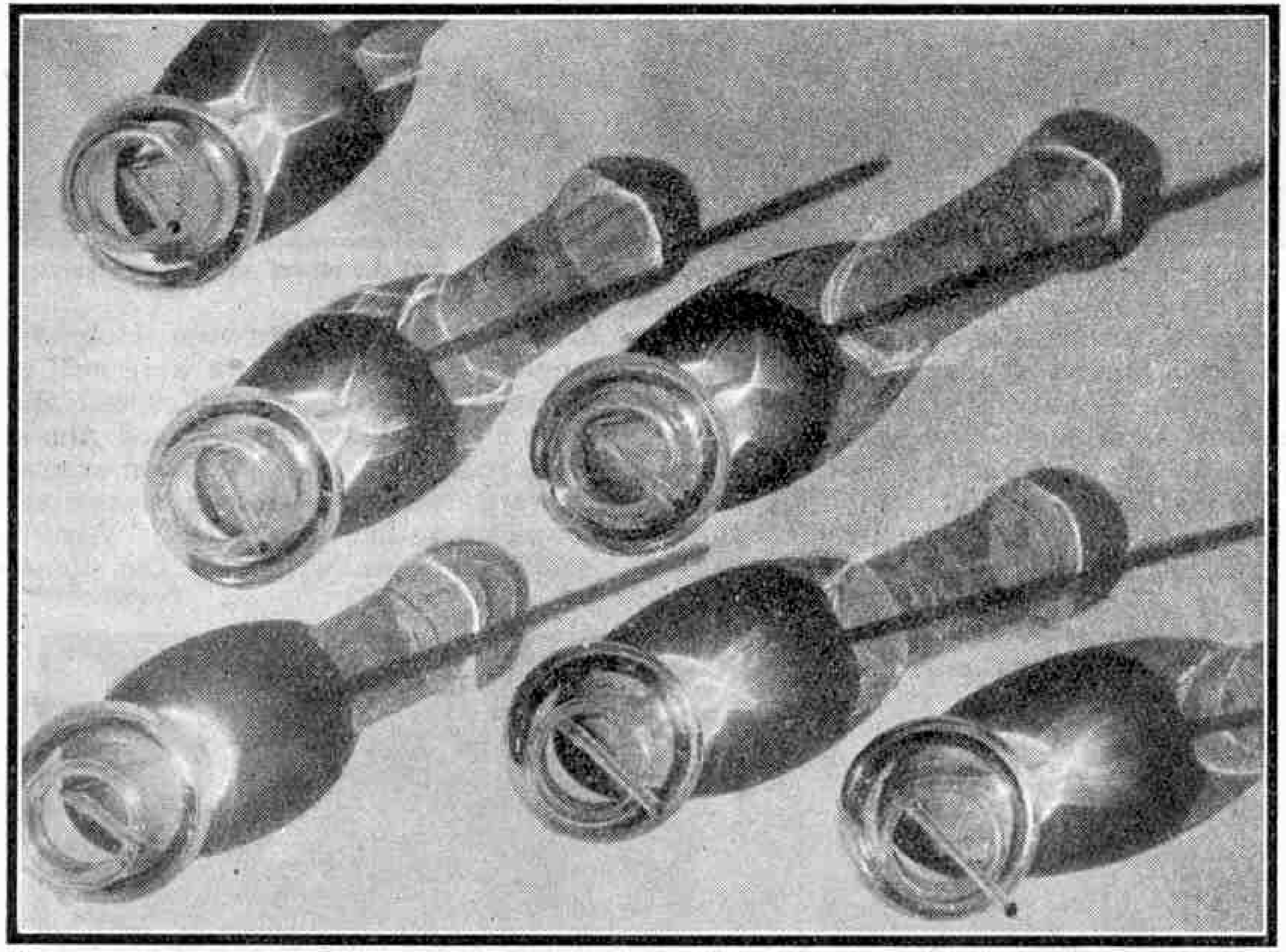
Vol. XXI. No. 6
June, 1936

With the Editor

An Absent-minded Professor

On 10th June it will be 100 years since the death of Andre Marié Ampère, one of the great pioneers of electricity. Ampère's name of course is familiar to every boy who has interested himself in electricity, for whenever we speak of a current as being of so many amperes we are paying tribute to the man and his work.

Throughout his career Ampère was so wrapped up in his studies and experiments that he knew little of what was going on around him. This is shown by the well-known incident that occurred at a meeting of the French Academy, at which he read a paper. On returning to his seat he found that a stranger had taken possession of it, and tried to compel the intruder to leave, completely oblivious of the fact that this was the Emperor Napoleon! The Emperor was greatly amused, and invited the scientist to dinner next day; but by that time Ampère had returned to his research and had completely forgotten both the Emperor and his invitation!



What are the mysterious-looking objects seen in this photograph? A prize of 10/6 is offered for the most complete solution to this puzzle received by 20th June. Solutions should be written on postcards only and addressed "June Editorial Competition," Meccano Magazine, Binns Road, Liverpool 13.

The *"Hindenburg's"* Record Flights

The record flights of the *"Hindenburg"* across the North Atlantic Ocean have raised once more the question of the value of airships. The great German airship made her first westward voyage in 68 hrs. 38 min. and returned in the remarkably short time of 48 hrs. 18 min., in each case with over 50 passengers and a considerable quantity of mails and cargo. Throughout the two flights the vessel travelled smoothly and easily, and the passengers seemed to have been greatly impressed by the absence of noise, and the comfortable and restful character of their crossing. In this respect the airship has a great advantage over the aeroplane, which is noisier and less roomy, although of course it is speedier.

The success of the *"Hindenburg"* may lead to a revival of interest in vessels of this kind in other parts of the world. Airship construction was stopped in this country and in the United States after the disasters to *"R101"* and the two American airships *"Akron"* and *"Macon,"* and only in Germany was the belief in the value of these great vessels retained. The achievements of the *"Hindenburg,"* and of the *"Graf Zeppelin"* before her, have completely justified this confidence; and if the new vessel maintains as regular and steady a service as her predecessor did on the South American service, we in this country may have to change our views. A new airship building programme already is being considered in the United States.

A Great Airwoman

Two months ago I made reference to the record-breaking flight to South Africa and back of Flight Lieutenant T. Rose, who made the outward and inward trips in a total time of about 10 days. As if this were not sufficiently astonishing, new records have now been created by Mrs. Mollison, who covered the 6,700 miles to Capetown in a little more than three days, and accomplished the return journey in less than five days, thus reducing the total time by more than two days.

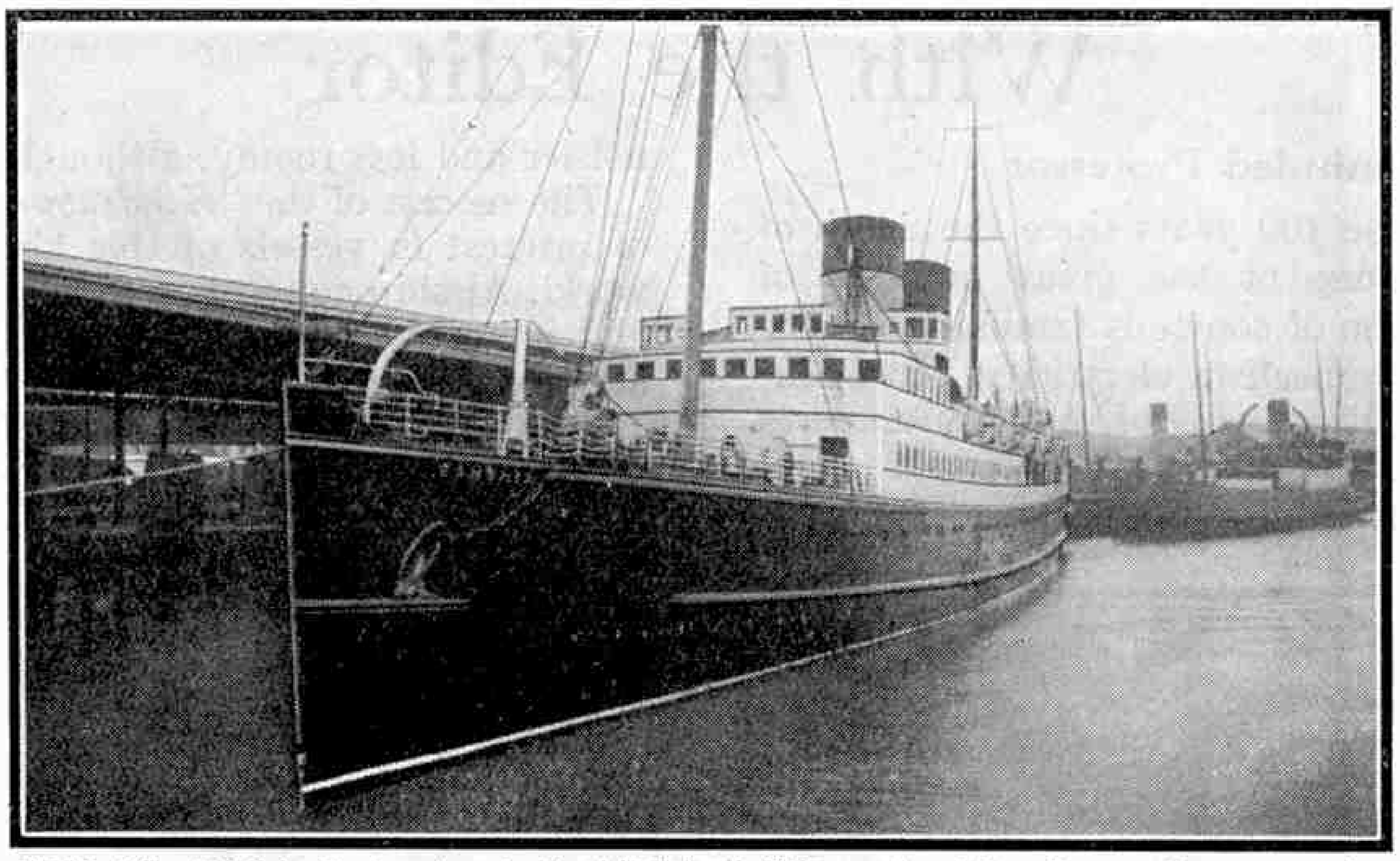
This wonderful achievement is a tribute to Mrs. Mollison's skill and endurance, and to her great ability as a navigator. She had to cross the Sahara Desert, a flight of 2,000 miles, at night and flying blind; and at a later stage of the flight it cannot have been easy to find the aerodromes, some of which were hidden in the depths of the equatorial forest. She made no mistake, however. Her flight must be ranked as one of the most daring and successful ever achieved, and her welcome on again reaching this country was well deserved.

Carrying the Irish Mail

Holyhead to Dun Laoghaire by R.M.S. *"Cambria"*

By O. S. Nock, B.Sc., D.I.C.

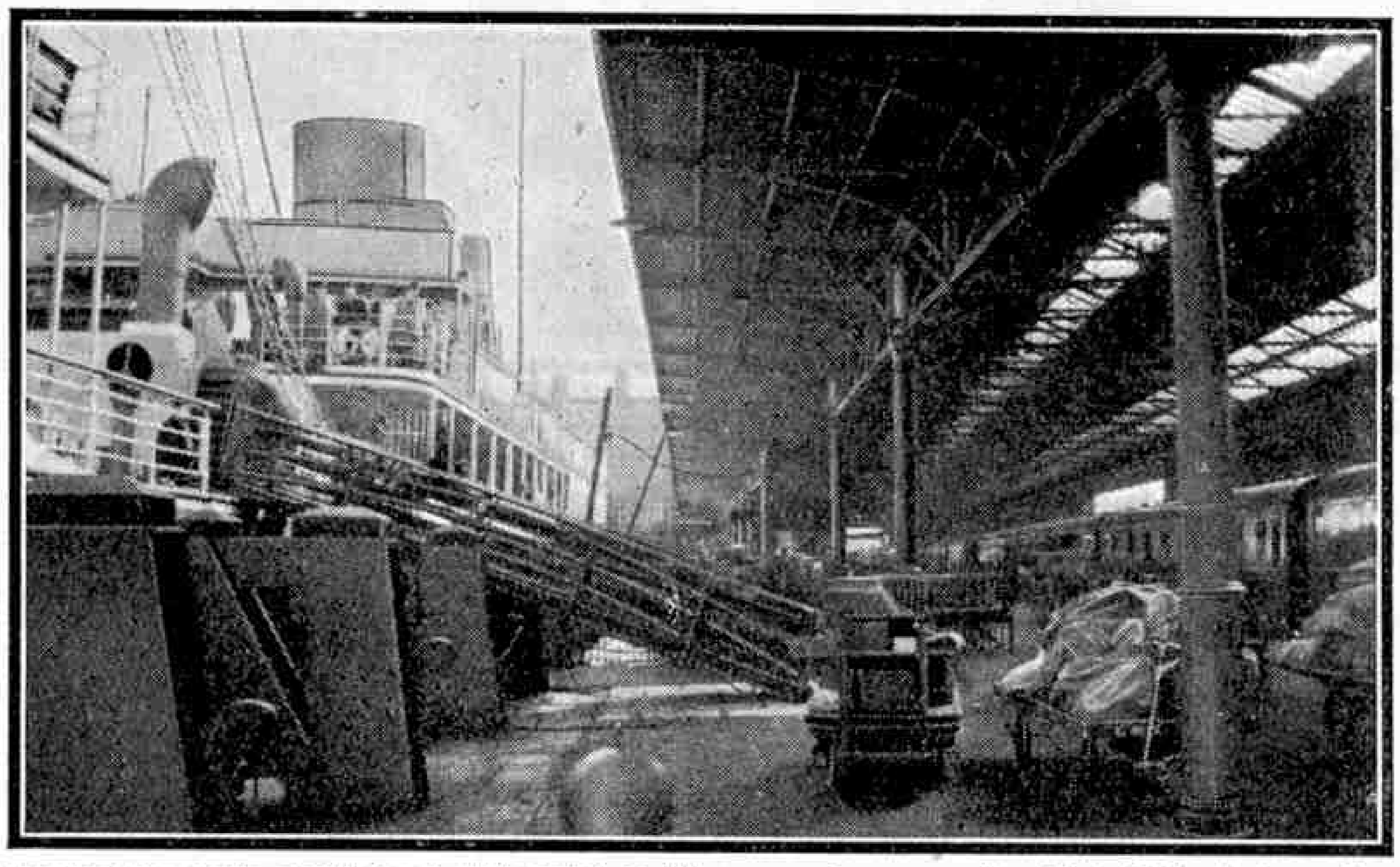
THE history of the conveyance of the Irish Mail is one of the greatest romances of transportation. One of the earliest of a remarkable series of engineering works designed to lessen the journey between London and Dublin was the Holyhead Road constructed by Telford. When the coaches gave place to the railway, Robert Stephenson built the world-famous tubular bridge over the Menai Strait, a fitting counterpart to Telford's beautiful suspension bridge little over a mile away. Then the very first water troughs in the world were laid down near Bangor in 1861 to enable the Irish Mail to make longer non-stop runs. Now that these wonders have become almost a commonplace, the service is distinguished by some of the fastest cross-channel ships in the world, and certainly the fastest coal-burning vessels.



R.M.S. "Cambria" in the departure berth at Holyhead. This vessel and the others on the same service are capable of a speed of 25 knots.

These splendid ships, the *"Cambria," "Hibernia"* and *"Scotia,"* were built specially for the London and North Western Railway's Irish service. For the last hundred years the mails have always been landed at Kingstown, a fine harbour on the south side of Dublin Bay about seven miles from the Capital. Until 1860 the mails were carried by an Admiralty steam packet, but in that year the contract for their conveyance was awarded to the City of Dublin Steam Packet Company, who maintained the service till 1920, when it was taken over by the L.N.W.R. It was after the creation of the Irish Free State that Kingstown became known once again by its ancient title of Dun Laoghaire.

The inner harbour at Holyhead is V-shaped. Approaching the station, the up and down railway tracks divide, one going to the left and the other to the right of the V; they then run right alongside the steamer berths. In the arrival berth was the *"Hibernia,"* which had come in just before noon with the east-bound day mail. Our ship was the *"Cambria,"* and from her decks the graceful lines of the sister vessel on the opposite berth were seen to great advantage. These are big ships; their gross tonnage is 3,470, the turbines develop no less than 16,000 h.p., and like all other L.M.S. cross-channel ships their boilers are fired with coal.



Loading the mails at Holyhead. "The Irish Mail" express is seen on the right of this photograph.

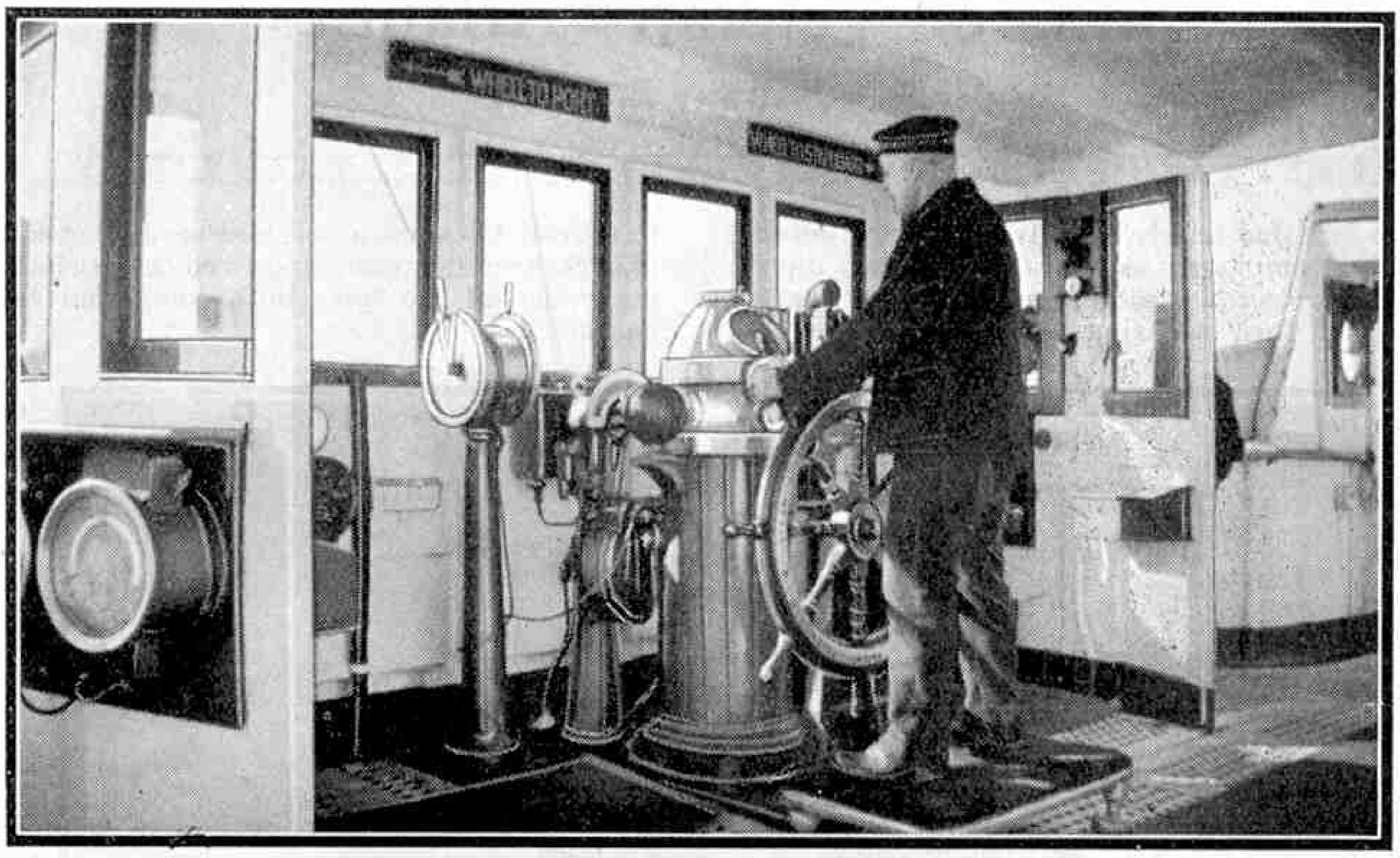
Holyhead Harbour is a long narrow channel in which it would be a slow and difficult business to turn ships of such size as the *"Cambria"*; and so, like the L.M.S. steamers on the Heysham-Belfast route, these vessels are fitted with bow rudders so that they can navigate stern first quickly; speed is always a first consideration with the Irish Mail. They are fitted with a second bridge, abaft of the funnels, from which the ship is driven when going astern, and here, a few minutes before sailing time, I joined Captain Turner.

On the stroke of 2.30 p.m. the gangways were let down, and then, by means of a rope stretched across to the opposite berth, the stern was slowly swung out from the quayside. Then, "Let go!"; the rope falls into the water with a resounding smack, and at the same moment "Half speed astern" is signalled to the engine room. A very slight quiver goes through the ship as the turbines start—the after bridge is right over the engine room—and we are under way. The harbour lies under the shelter of Holyhead Mountain and the narrow waterway leads north at first, but as we reach the outer harbour our course veers north-east for a while. Just at the turn there is an awkwardly placed sandbank, but apart from this Holyhead is an excellent harbour to enter or leave, with deep water on all tides.

We passed the old Admiralty pier from which the mail boats used to sail prior to 1880, and so came out into the wide natural harbour that lies between Holy Island and the mainland of Anglesey. As soon as we were well clear of the jetty the Captain changed right over to full speed ahead. Of course the turbines were not immediately reversed; the steam pressure has gradually to be reduced to zero, and then as gradually increased again on the forward turbines. In the meantime the ship was being swung round on to her true course, "West by North a half North"; this was to take us, with only the slightest changes, right across the Irish Sea.

As we changed over from steaming astern to ahead, two black balls that had been hoisted on the after mast were run down. With all these ships fitted with bow rudders some signal is needed to tell other craft that when steaming astern they are not merely manœuvering, but that for the time being their stern is their bow. In daylight the two black balls are hoisted, but at night a more elaborate signal is needed. In the ordinary way all ships carry two white mast-head lights, that on the forward mast being some 15 ft. lower than that on the rear mast, so that a ship on either beam can tell at once in which direction the vessel is steaming. At the same time a green light is carried on one side of the bridge and a red on the other to give the same message to oncoming ships. The *"Cambria"* and her sister vessels carry two distinct sets of navigation lights, one for ahead and one for astern; when direction is changed one set is extinguished and the other lighted.

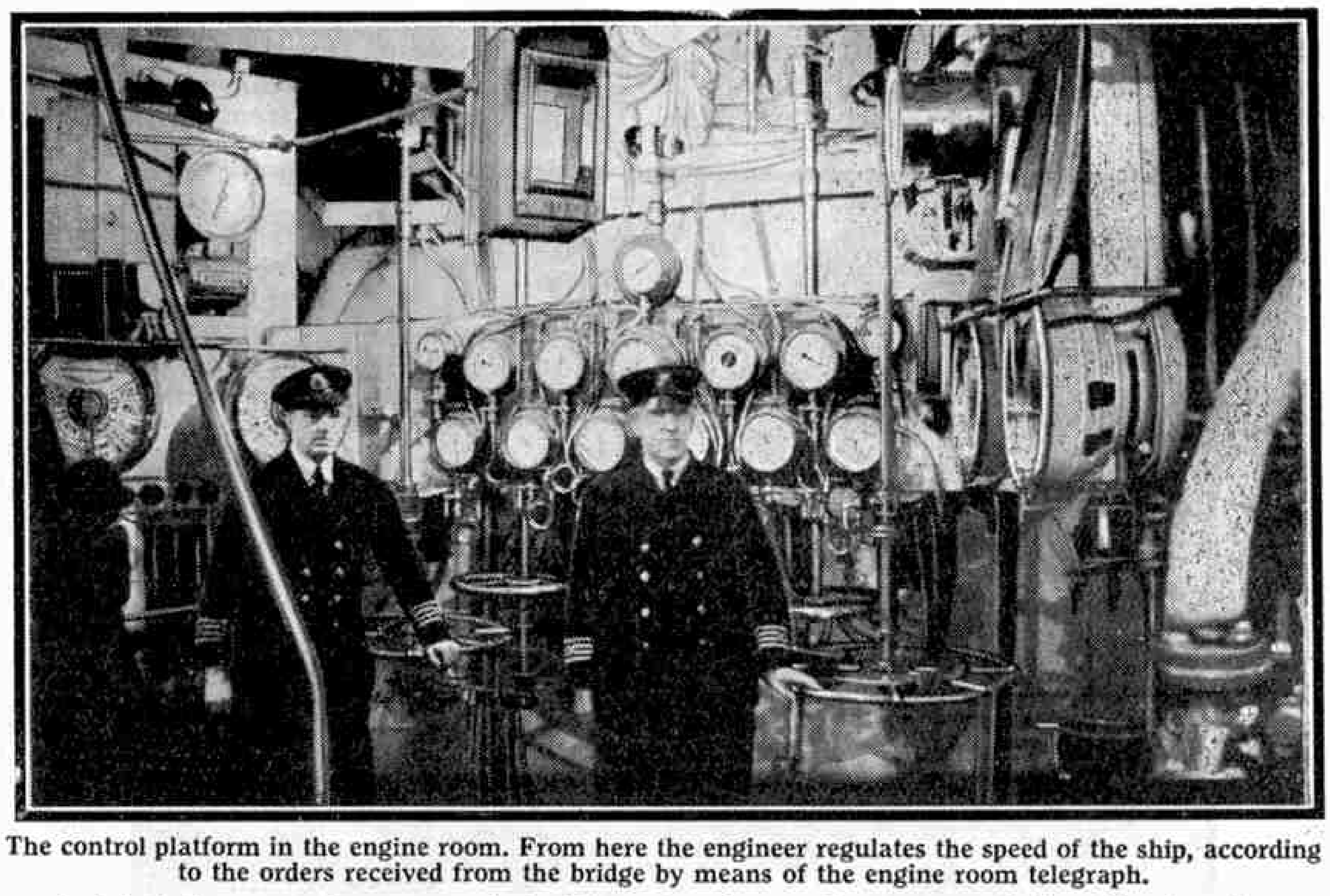
By now, steaming at 23 knots, we were passing the end of the Holyhead breakwater; this is nearly 8,000 ft. long and shelters the entire haven. Southward, Holyhead Mountain towered up behind the sheer precipices of the North Stack rocks, and farther away was an even more dramatic piece of cliff scenery, the South Stack. This rocky islet, black and forbidding even on the fairest day, is crowned by a fine lighthouse; a small suspension connects the Stack with the mainland and adds not a little to the wild beauty of the scene. Away to the north the Skerries lighthouse gleamed white in the sunshine; the sea was an intense blue, and far away to the south-east loomed the giants of Snowdonia. Although it was brilliantly clear on the sea a distinct haze hung over the land, and the mountains appeared as a vague bluish-grey cloud; here and there a whitish gleam told of snow lying deep in the crevices. As we came out into the open sea the tide was running strongly in the race under the North Stack and for a few minutes the "*Cambria*" was pitching slightly; but as Holyhead Mountain receded into the haze the sea became extremely placid, shimmering in the brilliant sunshine.



In the wheelhouse of R.M.S. "Cambria." "Full speed ahead" is the order, as is very necessary if time is to be kept.

* * * * *

Half way down the vertical ladder leading into the engine room there is a very striking view of the whole layout. Just below are the main turbines, one driving each of the propeller shafts; the rotors of the turbines run at about 2,500 r.p.m. and they are geared down so as to give a propeller shaft speed of about 250 r.p m. These ships are capable of the remarkable speed of 25 knots, though 22 to 23 knots is sufficient to keep schedule time, which is always adhered to very strictly. Beyond the turbines, still looking from our stance on the ladder, is the control platform, and all its gauges, clocks and dials are mounted from the wall, or bulkhead as it is called in a ship, that divides the engine room from the stoke-hold.



The control platform in the engine room. From here the engineer regulates the speed of the ship, according to the orders received from the bridge by means of the engine room telegraph.

Coming now to the control platform itself, among the many gauges is a counter that records the number of revolutions of the propeller shafts; it is by means of this instrument that the speed of the ship is regulated. The engineers know the exact number of revolutions that the shafts make during the complete crossing, and they calculate beforehand what the total revolutions should be at 10-minute intervals during the voyage, at 3.0 p.m., 3.10 p.m., 3.20 p.m. and so on. By checking the reading on the counter at these times they can tell very accurately whether they are ahead of or behind time, and can regulate the speed of the turbines accordingly. The working pressure of the boilers is 200 ℔. per sq. in., but to maintain 22 knots only about 175 ℔. per sq. in. is necessary. While I was on the control platform the Second Engineer checked the speed; the revolution counter showed that we were approximately 1½ minutes ahead of time, and so the very slightest reduction was made in the steam pressure in order to slow the ship down just a trifle.

There are nine boilers of the standard Babcock and Wilcox water-tube type, though of these only eight are used normally. All these boilers are hand fired, there being one stoker to each boiler. In crossing from Holyhead to Dun Laoghaire they burn between 20 and 23 tons, according to the weather; this means that each stoker fires a little under a ton per hour, which is about the same as on a modern express locomotive. Forced draught is used, and the upward current of air through the stokehold when going full speed is tremendous.

* * * * *

I came up on to the bridge again when we were just over half way across; the coast of Anglesey was just a vague line, but as yet there was no sign of Ireland. A bank of grey cloud hung on the western horizon, above which some thundery cumulus looked like a vast fantastic mountain range. The Chief Officer pointed out a topsail schooner far away on the starboard bow. Now, right ahead of us, the clouds were lifting to show a small arc of brighter sky on the horizon, and right in the centre of this patch was the Kish lightship, our first contact with Ireland. This beacon is anchored at the entrance to Dublin Bay; there are no rocks or shallows anywhere near, but it forms a useful point to steer towards. We were still steaming in brilliantly fine weather, but rainstorms were chasing each other northward along the Irish coast, and in the wake of one of these squalls came a first glimpse of land. A slanting grey mass was moving slowly across towards the Kish and in the brightening sky to the south there appeared, little by little, the outline of Bray Head and of the Wicklow Hills behind. There was a wistful and exquisite beauty about the way in which these mountains gradually took shape out of the mist. On the north side of the bay the Hill of Howth loomed out of the haze. In the earliest days of the service the Irish Mail was landed at Howth; to this little harbour came the old Sailing Packet in the times when it took four days to get from London to Dublin. The first steam packet also landed the mails at Howth. Just to the north of the promontory called the Nose of Howth was "Ireland's Eye," a rocky islet, and far to the north I could just pick out the profile of Lambay Island.

By the time we passed the Kish the coast stretching away to the south was being steadily revealed in all its beauty. The south side of the Bay has a fairly low coastline, but many miles to the rear is the long, high undulating ridge of the Dublin Hills, their crests still barely distinguishable from the grey of the clouds. Soon we were abreast of Dalkey; the spires of Dun Laoghaire rose against the sunset sky, and right ahead of us lay Dublin under a pall of smoke.

Like Holyhead, Dun Laoghaire is a real deep water harbour, and we maintained full speed almost up to the lighthouse. Right in the centre, running out from the shore, is the railway pier. We edged quietly up to the right-hand side of the jetty; we were alongside at 5.24 p.m., and in 2 hours 55 minutes almost to the second the gangways were run across.

There is a great tradition behind the carrying of the Irish Mail, and Captain Turner told me that if the mail steamers are only a minute late or early, Somebody wants to know why!

High Speed on the L.N.E.R. (G.C. Section)

Feats of Veteran "Atlantics"

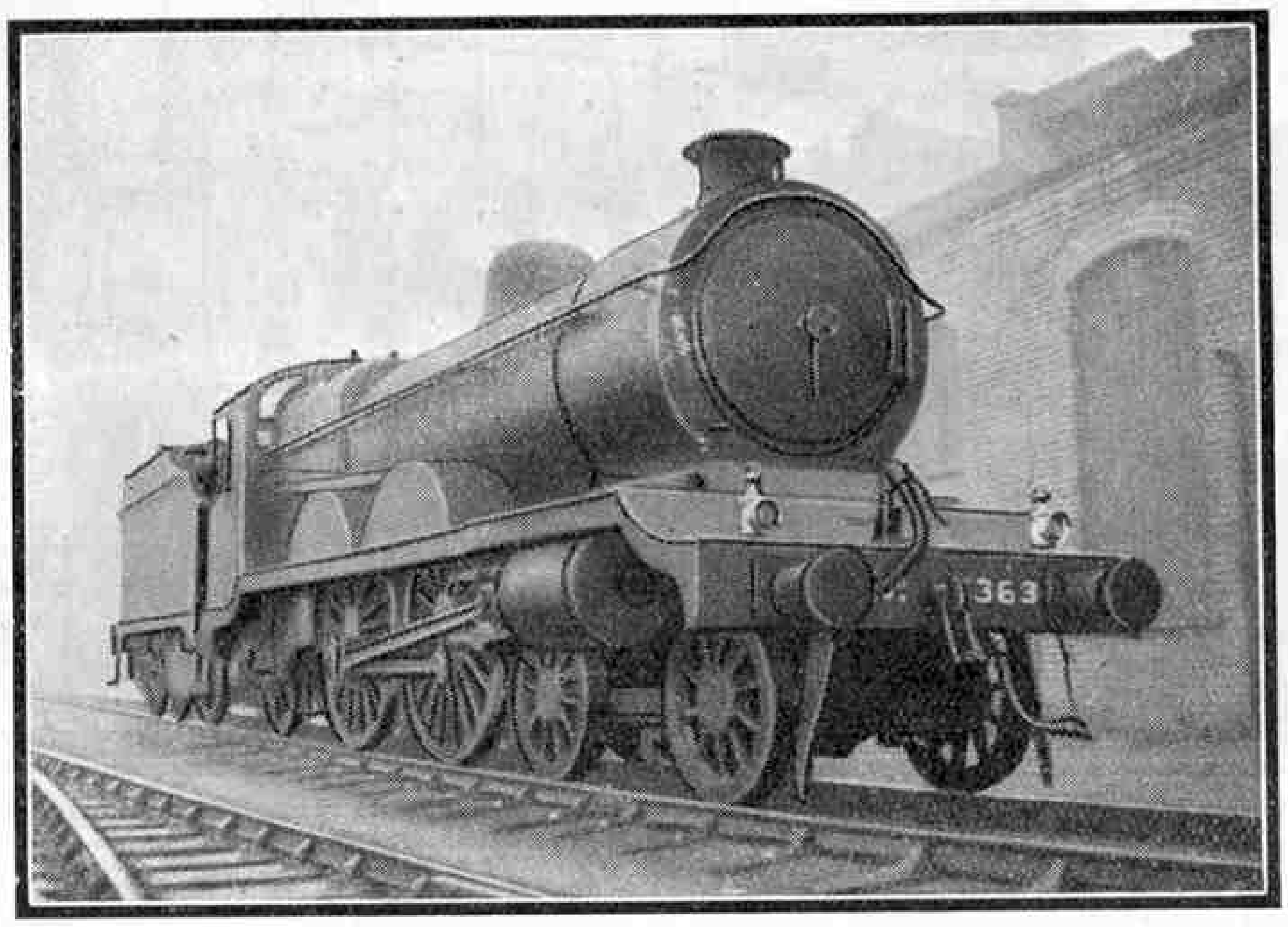
By a Railway Engineer

IT is a rather remarkable fact that nearly all British locomotives of the 1900–1910 decade still employed on first-class express duty are of the 4–4–2 type. Some recent exploits of the sturdy North British "Atlantics," and of their amazing counterparts on the Great Northern section of the L.N.E.R., were described in the "*M.M.*" in June and September last year respectively, but on the Great Central section of the same railway "Atlantics" built as long ago as 1903 are daily putting up work of equally fine quality.

An up Bradford express near Rickmansworth. The locomotive is L.N.E.R. No. 6088, one of the "Atlantics" of the former Great Central Railway.

The Great Central main line to London was not opened until 1899. At every important town the new railway was in fierce competition with well-established routes and from the outset was compelled to run a very high-speed service in order to attract custom. The zenith of the company's speed achievement was reached in 1905 when the famous "*Sheffield Special*" was booked to cover the 164¾ miles from Marylebone to Sheffield non-stop in 170 minutes.

In the early days of the London Extension loads were very light and 4–4–0 locomotives could manage the fastest trains successfully; but in 1903, to be ready for heavier traffic, Mr. J. G. Robinson brought out the first of his famous "Atlantics." Technically they were simple and straightforward, and outwardly one of the most handsome locomotive designs ever put on the road. At the time of their construction they were much in advance of the times, and it is indeed a tribute to the farsightedness of their designer that they can be relied on for such important work under the strenuous conditions of to-day.



L.N.E.R. (G.C.) "Atlantic" No. 5363. This is the engine that made the remarkable run described in this article.

In 1906 Mr. Robinson made a trial of compounding, and built four "Atlantics" as three-cylinder compounds arranged on the well-known "Smith" system. These engines were most successful, and all four are running as compounds to-day; as far as my own experience goes their performances are indistinguishable from those of the simple engines. Another interesting experimental "Atlantic" was No. 1090, now L.N.E.R. No. 6090. This engine ran for some time as a three-cylinder simple. In pre-War days the Great Central and Great Northern ran a joint service between King's Cross and Manchester on which Great Central engines worked the trains as far south as Grantham. No. 1090, in its three-cylinder days, was often employed on this duty, and made some very fast running over the Great Northern main line between Grantham and Retford; at this latter junction the trains branched off, and reached Sheffield by way of Worksop.

It was in applying the principle of superheating to the simple "Atlantics" in 1911 that Mr. Robinson designed the superheater that bears his name and is now used all over the world. The addition of superheaters greatly improved the work of the engines, and nearly every one of the type, both compound and simple, has been so equipped.

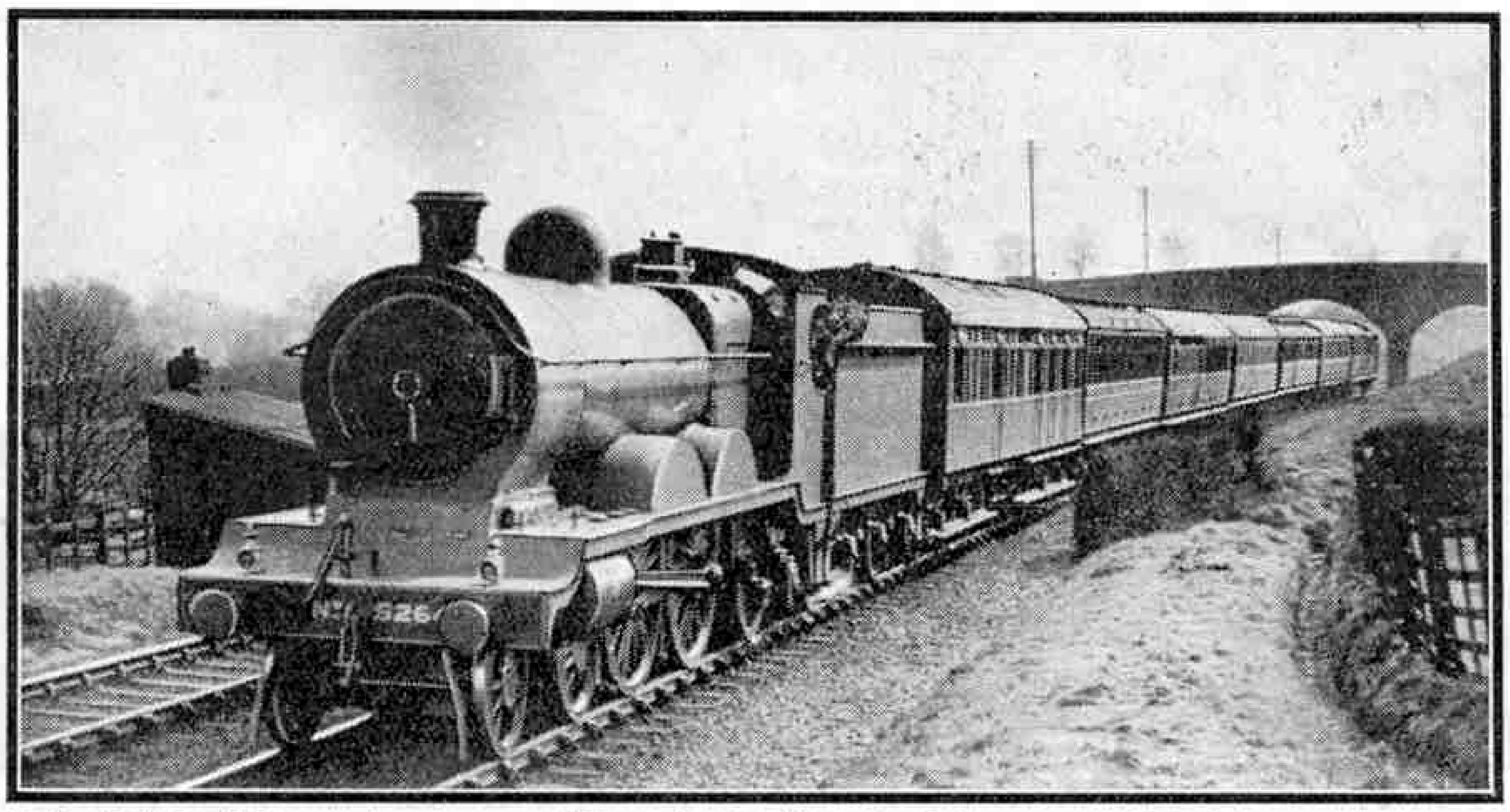
In 1913 the celebrated "Director" class 4–4–0s came out, but the "Atlantics" were only partially superseded on the best expresses, and since that date, although very big 4–6–0s such as the two-cylinder "Sir Sam Fay" class, and the still more powerful four-cylinder "Lord Faringdons," have been in regular service on the Great Central main line, the old 4–4–2s have still retained their place in first class duty. Oddly enough the "Atlantics" have established a reputation for being better hill climbers than the much larger 4–6–0s!

To-day Mr. Gresley's big three-cylinder 4–6–0s of the "Sandringham" class are at work on the Great Central section, but at the time of writing none of them have been stationed at Leicester; in consequence one of the hardest, if not the hardest, turn on the whole system, the 6.20 p.m. out of Marylebone, is invariably "Atlantic"-hauled. Owing to the crowded state of the Metropolitan Joint line via Aylesbury at this time in the evening, this express takes the longer route over the Great Western and Great Central Joint line, via High Wycombe. Until the beginning of this year, the 107.6 miles to Leicester were booked to be run non-stop in 114 minutes, an average speed of 56.4 m.p.h.; slip coaches were carried for both Finmere and Woodford, and the minimum load out of Marylebone was one of 290 tons.

This tonnage did not by any means represent the limit of "Atlantic" ability, and I have observed No. 6090, now a two-cylinder simple, to keep time with a load of 340 tons. Only on one occasion, just before August Bank Holiday, when the train was made up to no less than 370 tons, have I known a pilot engine used. It seems a far cry now to the old days of the "*Sheffield Special*" when the maximum load was about 170 tons!

At the beginning of this year the two slip coaches were withdrawn, and the train was booked to stop at Finmere and Woodford. The time allowed to Leicester is now 119 minutes, including half a minute at each stop; with a minimum load of 250 tons this schedule represents quite the hardest task ever set to Great Central engines. In the third week that the new timing was in force I travelled down to Leicester and was treated to a really magnificent performance. The load was one of seven coaches, 241 tons tare and 260 tons with passengers and luggage; at the head of the train was "Atlantic" No. 5363, a two-cylinder simple built in 1906, in charge of Driver Newall and Fireman Lees, who are attached to the Leicester shed.

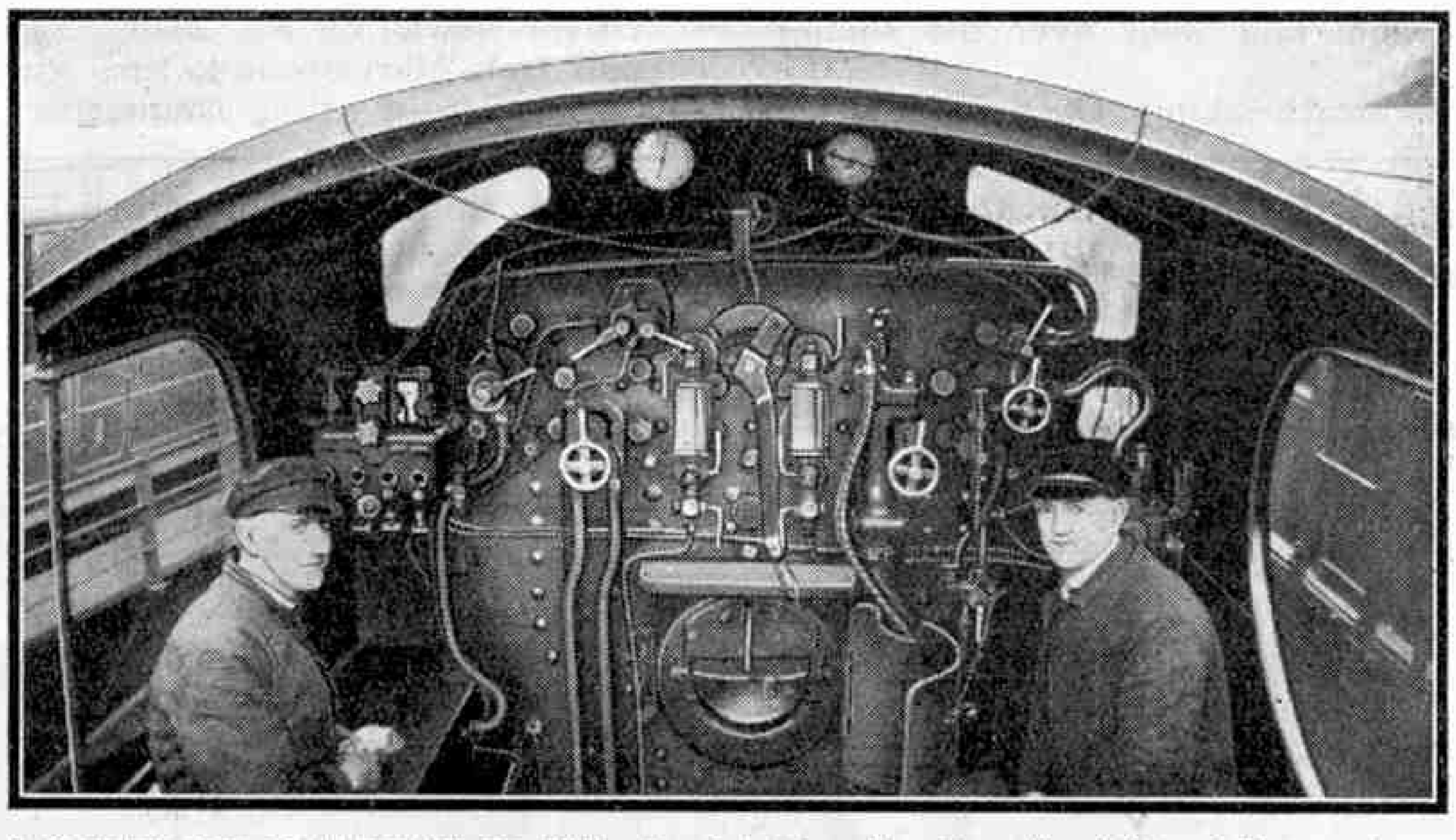
The cabs of these engines are much more spacious than those of most of their contemporaries. They are driven from the right-hand side, and the reversing gear is of the screw type. A double-port regulator is used, working on the same principle as that of the Midland Compounds. When the handle is in any position up to "half over" on the quadrant, steam is admitted through the small valve, or "first regulator" as it is usually called; beyond half way the main regulator is brought into operation. In contrast with the Great Northern "Atlantics," these engines have a long narrow Belpaire firebox, a distinctive feature of which is a fire-door placed unusually high above the footplate level. This of course makes for a cool cab, but, as in the case of the French locomotives that I described in the "*M.M.*" for March, does not ease the fireman's task. The G.C. "Atlantics" are most economical engines, however, and even on such strenuous turns as the 6.20 p.m. burn only about 45 lb. per mile, a satisfactory figure in the circumstances.



"Atlantic" No. 5264 on a down express. This engine has the tapered chimney provided after grouping in place of the wider curving pattern originally fitted. Photograph reproduced by courtesy of the L.N.E.R.

It was an ideal evening for fast running, calm and fine, and a severe permanent way slack in the early stages gave the driver an opportunity for some really exceptional work in making up the time thus lost. Getting away in fine style, the reversing gear was quickly brought back to a position half way between full and mid-gear, giving a cut-off of 40 per cent., and the regulator gradually opened to the full. Through Hampstead tunnels, climbing at 1 in 196–100, speed rose to 35 m.p.h. but fell back to 32 m.p.h. on the 1 in 95 to Brondesbury summit, where the North London line of the L.M.S.R. is crossed. Down the sharp descent to Neasden speed was not allowed to exceed 56 m.p.h., and immediately beyond the junction, where the Aylesbury route diverges, we encountered the permanent way slack, right down to 20 m.p.h. for nearly a mile.

Recovering speed steadily up grades averaging 1 in 200, we passed South Harrow summit at 43 m.p.h. and a moment or so later were easing up to take the burrowing junction at Northolt that marks the beginning of the Great Western and Great Central Joint Line.



A footplate view of "Atlantic" No. 5363, showing Driver Newall on the right and Fireman Lees on the left of the cab.

On account of the Neasden check, the 11½ miles to Northolt Junction had taken 19¾ minutes, 2¾ minutes over schedule; but now Driver Newall set about recovering the lost time with a vengeance. This is the route followed by the Great Western two-hour Birmingham expresses, and indeed it seemed as though the L.N.E.R. crew had pitted themselves against their G.W.R. rivals, so electrifying was our progress. In four miles of faintly rising line speed rose to 62 m.p.h., but then there begins the first stage of the ascent over the Chiltern Hills. As we approached Denham the driver opened out to full regulator but the cut-off remained unchanged at 40 per cent., in fact throughout from Marylebone to Leicester there was scarcely any variation from this figure either when working with the main or the first regulator. Meanwhile the engine was climbing splendidly. At Gerrards Cross after three miles of 1 in 175 grade we were doing 55 m.p.h.; beyond this station the rise continues at 1 in 254 and here No. 5363 accelerated rapidly to 60 m.p.h. before passing the summit near Beaconsfield. At this point she was developing nearly 1,500 horse power—a wonderful figure for so moderate-sized an engine.

Readers who have travelled on the Great Central route cannot have failed to notice periods in every run when an intense rain of cinders falls on the carriage roofs, and probably will have attributed it to fire-throwing of a most extravagant kind. Actually it is the ejection of accumulated ash in the smoke-box. With any locomotive a good deal of ash collects around the blast-pipe during a run, and I have seen engines arrive at their destination with a great heap piled high above the nozzle. By means of this ingenious ejector on these G.C. engines the ash can be blown out periodically during the run, and the smoke-box kept not only clean but, what is more important on turns such as these, cool. On this run Driver Newall put the ejector on for the first time just after passing Gerrards Cross.

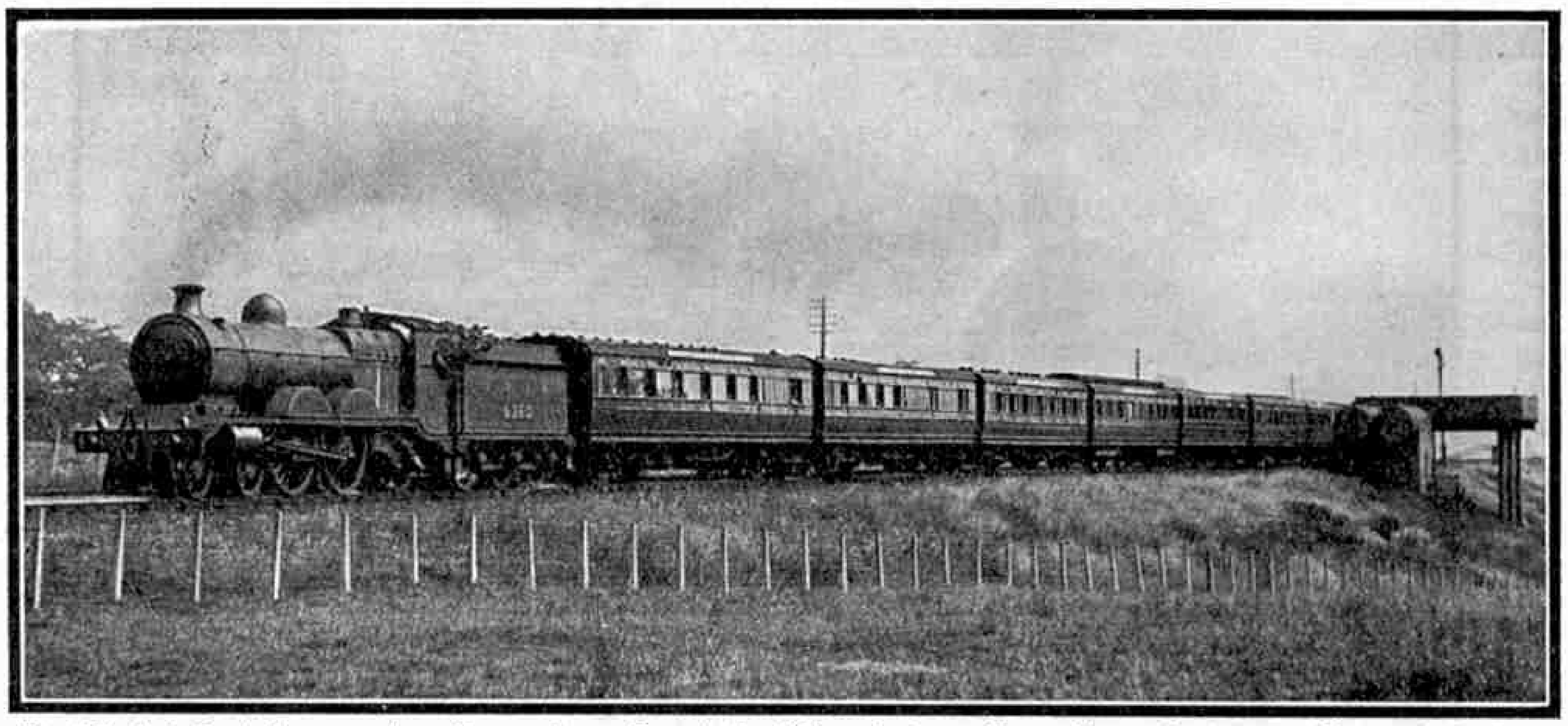
Changing over to the first regulator on passing Beaconsfield, we began the dip to the valley of the River Wye in dashing style with a maximum speed of 73 m.p.h. at Tylers Green, but unfortunately this break in the climb cannot be taken full advantage of owing to the permanent speed restriction to 35 m.p.h. through High Wycombe. On passing this station, however, we had run the 16 miles from Northolt Junction in 17 minutes, and already one minute of lost time was regained. Speed was picked up splendidly on the steep rise that follows, and by Saunderton summit we were steadily maintaining 48 m.p.h. up the 1 in 164 gradient. Far from there being any suspicion of shortage of steam after this hard work, No. 5363 approached the top "blowing off."

Now the regulator was brought back to the first port, and for the first mile-and-a-half of descent the acceleration was positively uncanny. We stormed through Princes Risborough at 73, and four miles farther on attained the terrific maximum, for an engine of this age, of 88 m.p.h. Over the last four miles of the Joint Line speed lay entirely between 75 and 82 m.p.h. on a stretch which, although undulating is no more than level on the average. The 34 miles of the Joint Line, from Northolt to Ashendon Junction had been covered at an average of exactly 60 m.p.h., inclusive of the slack through High Wycombe and the climb over the Chilterns! Passing Ashendon at 78 m.p.h. we kept up a tremendous pace, and even after a mile rising at 1 in 175 were still doing 68 m.p.h. when we rejoined the Aylesbury route at Grendon Junction. The 51¼ miles from Marylebone had been covered in 59 minutes, while over the last 15.3 miles we had averaged 75.2 m.p.h.

Just before Grendon, Driver Newall had reverted to the main regulator; we romped over the sharp ups and downs past Calvert at 65–70 m.p.h., and after three miles of continuous climbing at 1 in 176 had not fallen below 61 m.p.h. when steam was shut off for our first stop, at Finmere. The 59 miles had been run in 66¾ minutes; the whole of the loss caused by the Neasden slack had been wiped out and we were three-quarters of a minute early—a brilliant effort indeed. The net time was a little under 64 minutes.

The next section is a very difficult one. A timing of 16½ minutes start to stop for a run of 14.6 miles would need good going on the dead level, but between Finmere and Woodford there are nine miles rising it 1 in 176! Starting on this grade we were up to 38 m.p.h. in 1½ miles; then comes a dip for 1¾ miles at the same inclination. Accelerating like lightning we got up to 63 m.p.h. before tackling the 5½ miles of Helmdon bank where speed fell to a sustained 54 m.p.h. Onward to Culworth the line still has a rising tendency, though not so steep; but with almost full regulator we reached 67 m.p.h., and a minute later, after a short length of down grade, swept over Culworth Junction at 76½ m.p.h. But even with this magnificent running we failed to keep time, although the loss was only 41 seconds.

The last 34 miles from Woodford into Leicester are scheduled in 34 minutes. A stop of half a minute's duration is all that is allowed at both Finmere and Woodford, and slight overtime in each case made us three quarters of a minute late on leaving Woodford. But Driver Newall got some more brilliant work than ever out of No. 5363, made the final run in 32½ minutes, and brought us into Leicester nearly a minute early. Starting once again up a gradient of 1 in 176, we passed Charwelton, 2½ miles out, at 46 m.p.h., and then approaching the south portal of Catesby Tunnel Newall went over to the first regulator. From this point there is an unbroken descent of 7 miles at 1 in 176; acceleration was a little slow at first, but once into the "seventies" we simply romped away and touched 82 m.p.h. at Braunston. Keeping up 74-75 m.p.h. along the level beyond, we had not fallen below 64 up the sharp rise to Rugby, and then simply flew across the long viaduct over the L.M.S.R. main line at 73 m.p.h.


The "Ports to Ports" express from Newcastle-on-Tyne to Cardiff passing over Charwelton water troughs. The engine is Great Central "Atlantic" No. 5360.

Now came the ascent of Lutterworth bank, which consists of 5½ miles at 1 in 176, a dip of 2 miles at the same grade, and then a final 2½ miles again at 1 in 176 to the summit. After nearly two hours of such tremendously hard running some slight flagging in the engine's effort might have been anticipated here, but not a bit of it! Throughout the run Fireman Lees had kept the needle almost stationary at full boiler pressure, and we commenced this last climb with the engine blowing off. Without giving the speed a chance to fall, the regulator was pushed hard over immediately we came on to the grade, with the result that we took the first stage of the ascent at a minimum speed of 56 m.p.h., touched 67 on the dip through Lutterworth station, and went over the summit at 61 m.p.h.

The finish into Leicester was breath-taking. Once we were well over the crest of the bank, the regulator was brought back to the second port and speed rose to a well-sustained 87 m.p.h. at Whetstone. For several miles beyond, on a descent no steeper than 1 in 400-650, we kept up a steady 84-85 m.p.h., and within a mile of the stop we were still doing 80! The 8.2 miles from Ashby to Leicester South Goods Junction were covered in 2 seconds under 6 minutes, an average speed of 82.5 m.p.h., while for 27 miles of this thrilling last lap the average was 71.3 m.p.h. So the 34 miles from Woodford to Leicester were run in 32½ minutes.

On the complete run from Marylebone Driver Newall had made a net gain of 5 minutes on these difficult timings, and this was equivalent to a non-stop run over the 107½ miles in 108½ minutes. In response to my congratulations the driver remarked that No. 5363 was "the strongest engine he had ever driven"; certainly he put its strength to some purpose! As he further explained, they have acquired such perfect familiarity with the type that they can coax the very utmost out of them when occasion demands; such feats as this were quite unheard of in the so-called hey-day of the class, when for instance the *"Sheffield Special"* was made up of five or six coaches weighing 180 to 215 tons.

This performance was in the nature of a "swan song," however, at any rate as far as the Great Central "Atlantics" are concerned, for since the above was written they have been replaced at Leicester by some of the new "Sandringham" class 4-6-0s of the "Football Club" series. The "Atlantics" should still have a considerable lease of life, and a particularly interesting development is the transference of No. 6083 to Cambridge shed to work on the very fast buffet car expresses between there and King's Cross. In the meantime the redoubtable Leicester drivers have very quickly taken the measure of their new steeds. During the Easter holidays, Driver Newall on No. 2849, *"Sheffield United,"* worked the 6.20 p.m. from Marylebone to time with a load of over 400 tons behind the tender—a fitting counterpart to his "Atlantic" run.

Railway Electrification Developments

Some interesting railway electrification schemes are in progress or are shortly to commence. The Portsmouth electrification of the S.R., now well in hand, has already been referred to in the *"M.M."*

In the Wirral Peninsula, Cheshire, preliminary work is being done on the L.M.S.R. Wirral line. It is anticipated that this programme will be completed for Easter of next year. This will allow of the through running of trains between the Wirral line and Liverpool, in conjunction with the Mersey Railway. For these through services 19 all-steel electric set trains have been ordered by the L.M.S.R. Each train will consist of a third-class motor car with two motor bogies, a first-third trailer car and a third-class driving trailer. The cars will be of the centre-gangway type, with two wide doors on each side that will be air-operated under the control of the guard. This feature will ensure the rapid loading and unloading of the trains and the reduction of the time occupied at stations to a minimum. With a view to saving weight the contour of the coaches will be reduced from the size of normal L.M.S.R. main line stock, and the vehicles will resemble somewhat those in use on the London underground lines.

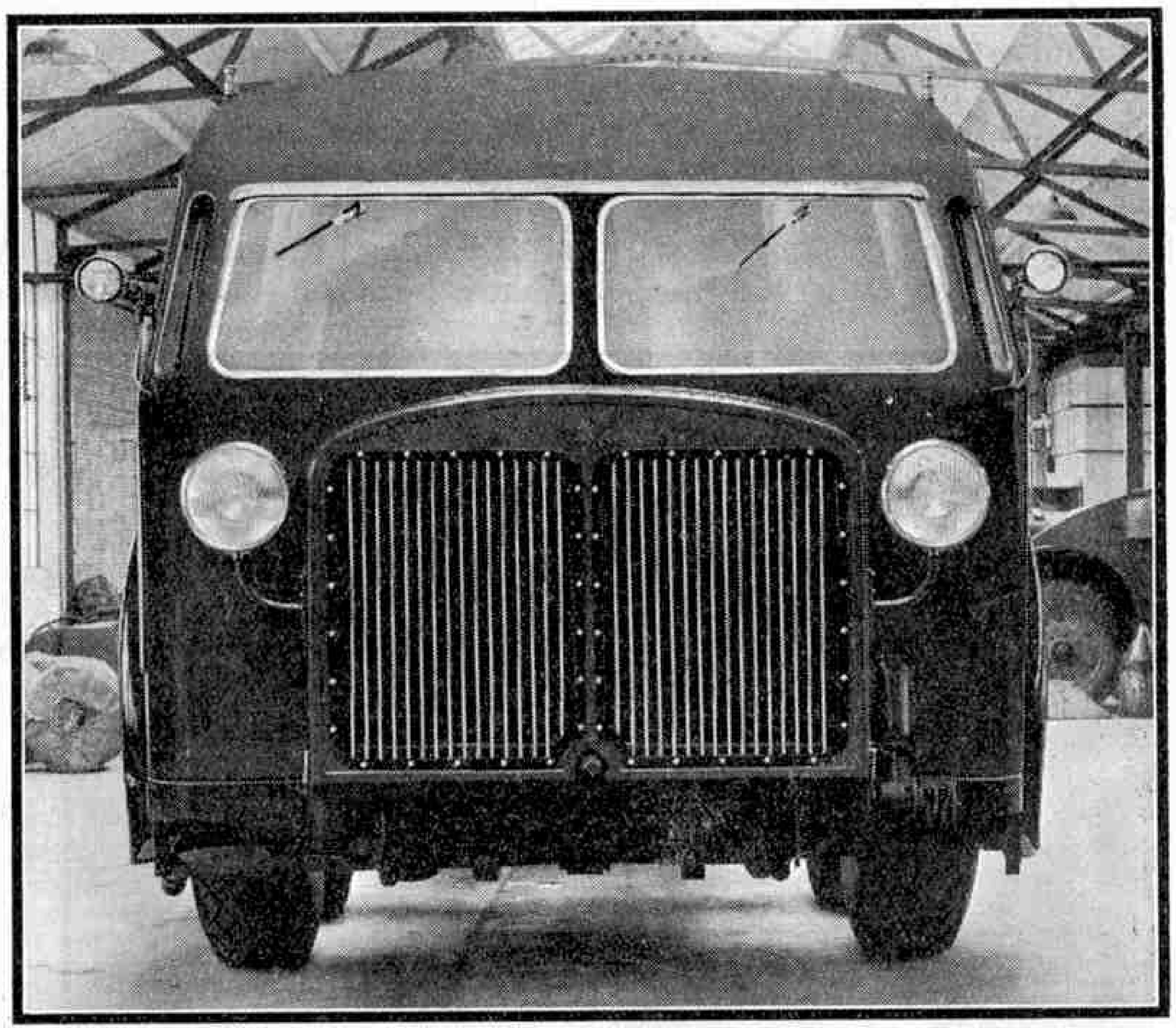
One of the Mersey Railway trains. These will be used in conjunction with new L.M.S.R. stock on through services, when the Wirral line electrification is completed.

The L.N.E.R. electrification of the Tyneside lines is to be extended from Newcastle to South Shields. The Tyneside lines were originally electrified in 1904 and were among the first surface lines to be converted from steam to electric working. The position of the conductor rail then differed somewhat from that now adopted as the national standard, and as the first move in the extension the opportunity has been taken quite recently to convert the Tyneside lines to this standard. Altogether some 80 miles of steel conductor rails had to be taken up and replaced. Insulators also had to be moved and the various track cables altered. The alterations to the cars were carried out at Gosforth car sheds.

Giant Tanker for Iranian Oilfields

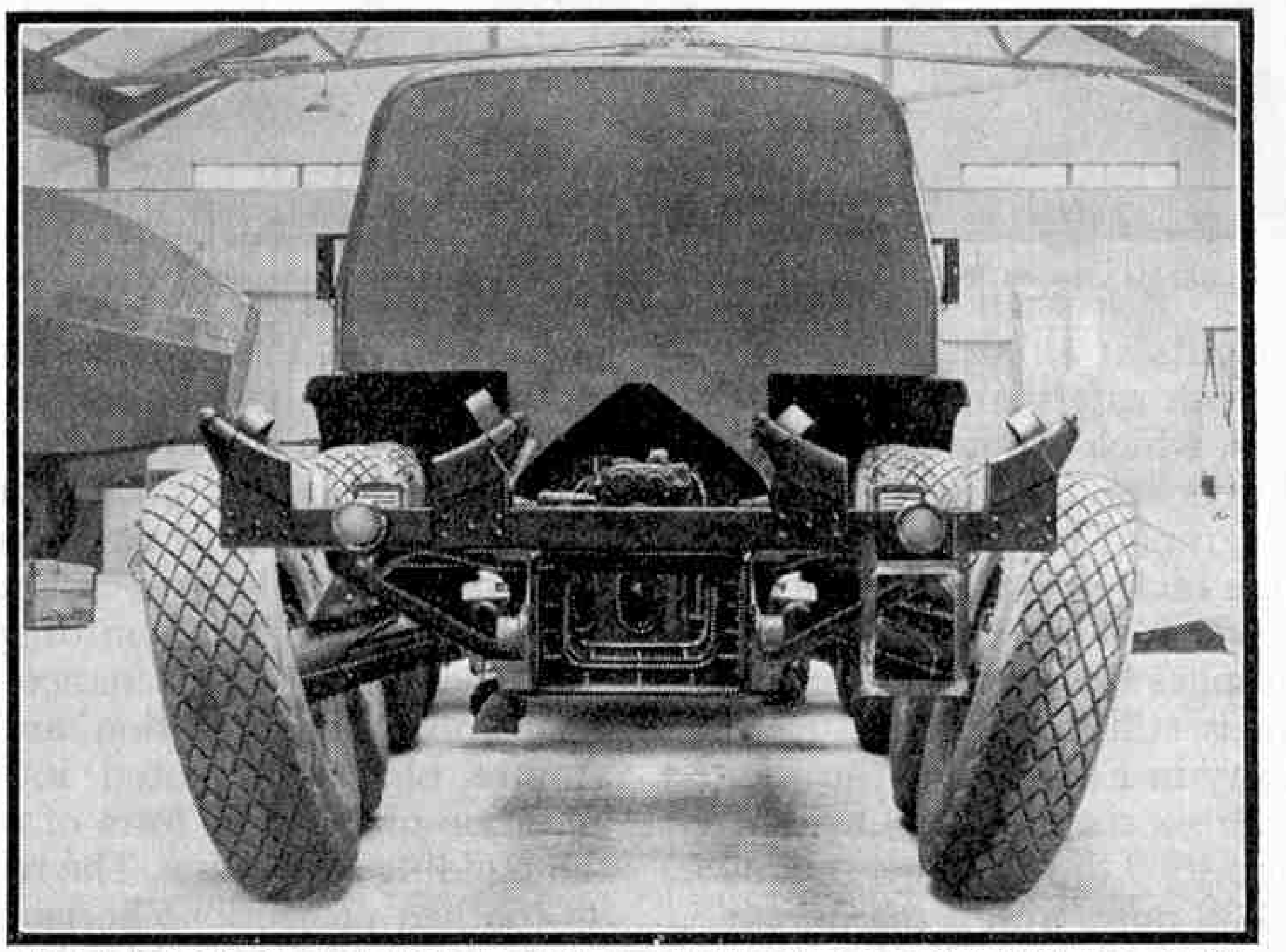
Ingenious Drive for Precipitous Mountain Roads

THE illustrations on this page show a 15-tonner Straussler oil tanker of striking design that has been built for use in Iran. The vehicle is intended to carry petrol in bulk from the oilfields of the Anglo-Iranian Oil Co. Ltd., in the Persian Gulf for distribution in Teheran, a route of over 400 miles, and in covering which it is necessary to traverse numerous hairpin bends and very bad road surfaces, some of which are snow covered in winter, and a mountain pass 8,000 ft. above sea level. The vehicle has been specially designed to cope with these difficult conditions, and every effort has been made to ensure good road-holding and stability by maintaining a low centre of gravity combined with four-wheel front drive. The necessity for the latter will be appreciated when it is known that the mountain road in many places runs along the edge of precipices many hundreds of feet in height, where the smallest degree of skidding or swaying might easily lead to disaster.



Front view of a 15-tonner Straussler oil tanker specially designed for work in the Iranian oilfields. It is driven by a 150 b.h.p. petrol engine and has a speed of 38 m.p.h. For our illustrations we are indebted to Straussler Mechanization Ltd., London.

The vehicle was built by Straussler Mechanization Ltd., of London, and to ensure that it was reliable for operation over such a dangerous route a trial was arranged over 2,000 miles of difficult mountain roads in the Austrian Tyrol and the Alps, a test from which it emerged successfully.



Each wheel of the Straussler oil tanker is independently mounted on hinged axle arms, and the drive is transmitted to the four wheels of the front bogie by means of universally-jointed shafts.

Some idea of the size of this fine machine, which is capable of a speed of 38 m.p.h. may be had from the following figures. The chassis alone weighs 7½ tons, whilst the oil tank loaded weighs 15½ tons. The weight of the complete vehicle unladen is 12 tons. The overall length is 25 ft. 10 in. and the width 9 ft., and the top of the tank is 9 ft. above ground level.

The chassis is fitted with a Straussler eight-cylindered V-type engine, which has a bore of 98 mm., and a stroke of 120 mm. and develops 150 b.h.p. at 2,800 r.p.m. The power is transmitted through a clutch and six-speed syncromesh gear-box to a short propeller shaft inside the gear-box. At each end of this shaft is a spiral bevel drive and differential, and from each of these run universally-jointed shafts to the four front bogie wheels, the shafts being enclosed in tubular arms hinged to the frame. The gear-box is provided with six levers, one for each gear, the connection between the levers and the box being by push-and-pull cables in flexible conduits.

The engine has overhead valves, which are operated by twin camshafts, and is fitted with highly efficient lubricating arrangements for supplying cool oil to all necessary points. In this connection it is interesting to note that the two centre cooling elements of the radiator form part of the circulating system for the oil, and are used for cooling the lubricant. The engine is fed with petrol from a 200-gallon compartment in the main oil tank, the fuel being pumped to the carburetters by two Tecalemit pumps.

Probably the most notable feature of the vehicle is the fact that each of the eight wheels, which are arranged as two four-wheel bogies is independently mounted, and that the drive is by the four wheels of the front bogie. The frame on which the wheels are mounted resembles a backbone and runs practically the full length of the chassis, being composed of two deep channel section girders set back-to-back, about 1 ft. 7 in. apart. These are strongly braced with cast steel cross-members, and to the outer sides are attached brackets for the tank cradles, rear springs and wheel arms, and at the front there is a structure for the engine and cab.

In line with the rear-bogie cross-member, which is of box formation, there is a pair of brackets, which carry on pivots, the central mountings of a pair of inverted semi-elliptic springs, longitudinally arranged. The ends of the springs rest upon the rear-bogie wheel arms and provision is made for universal movement at the point of attachment.

The forward suspension system also comprises duplicated transverse underslung springs, a pair being used for the two leading wheels and a pair for the two second wheels. This suspension system permits a wheel articulation of over 18 in., and ensures that the minimum of vibration caused by rough ground is transmitted to the frame.

Each of the stub axles is provided with its own steering box, all the steering boxes being operated by a system of shafts and bevels from the steering column. As a result of this arrangement the vehicle can turn in a 60-ft. circle and can be steered with great precision and ease in all circumstances.

To provide for all emergencies the chassis is provided with two entirely independent braking systems. At the two ends of the propeller-shaft tube are contracting-band-type brakes, which are applied by means of a lever in the cab. The second system is operated by a pedal, which applies brakes on all the road wheels through a Westinghouse compressed air apparatus and fluid transmission.

Some Mountain Railways of Switzerland

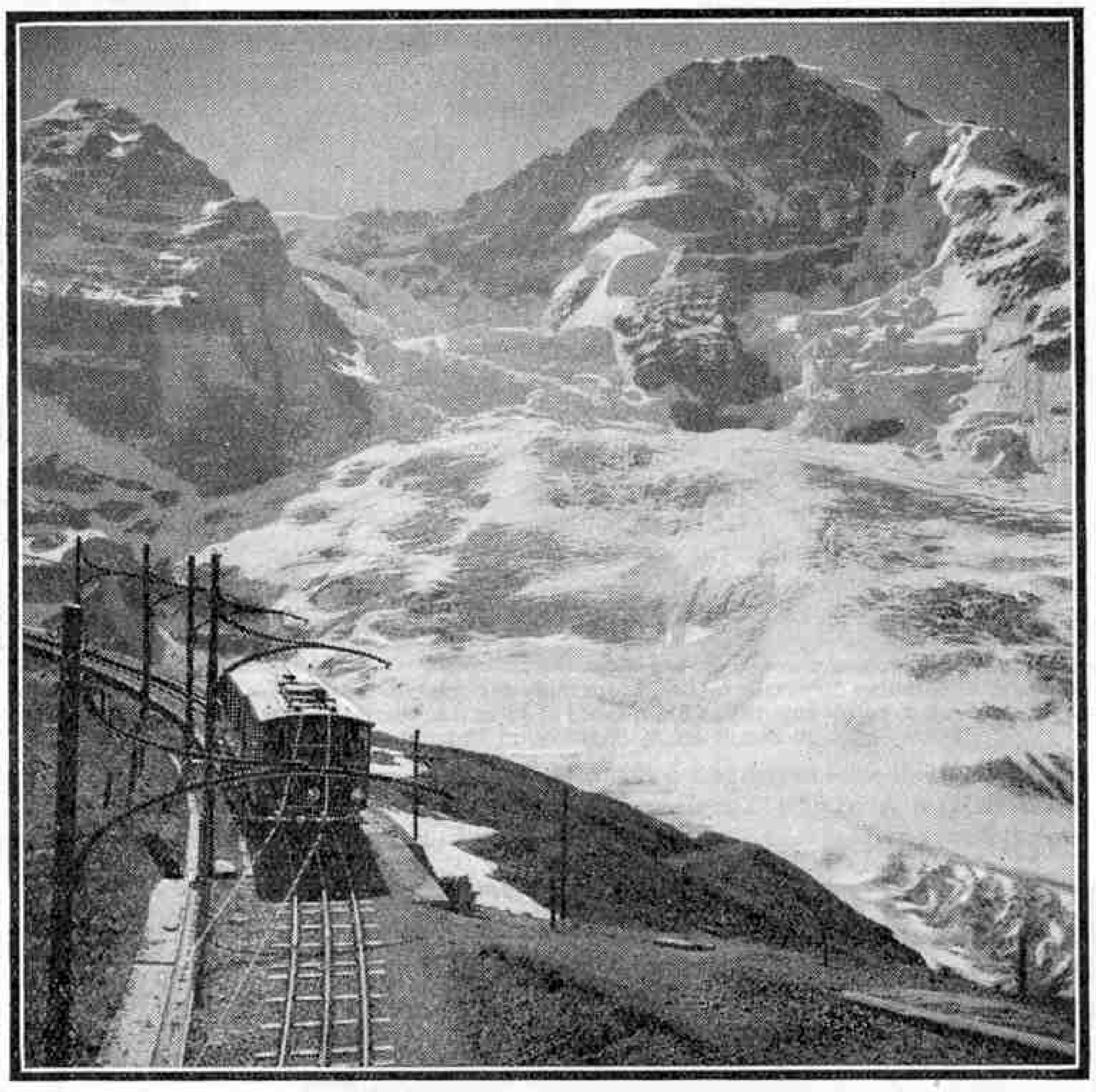
The Engineer's Triumph over Nature

IN the earliest days of railways, before the hill climbing capacity of the steam locomotive had been proved, engineers generally proposed routes that would give them as level lines as possible. If an unduly steep incline, according to the standard of those days, could not be avoided at a certain point stationary engines and cable haulage were freely suggested. The latter method was indeed used to a certain extent, and it persisted even until 1908 on the 1 in 41/46 Cowlairs incline on the main line out of Glasgow of the former North British Railway. Not only was the ability of the locomotive to surmount inclines considered doubtful, but difficulty had been anticipated even in securing sufficient adhesion between a smooth wheel and a smooth rail to ensure the haulage of loads on the level. This accounted for Blenkinsop's adoption in 1812 of a rack rail and toothed wheels on the steam-operated line at Middleton Colliery near Leeds.

How amazed some of the early experimenters would be if they could see the incline railways now operated in different countries, and particularly those in Switzerland! In that wonderful country the skill of the engineer has enjoyed many triumphs, but the most amazing are probably those achieved in connection with the mountain railways. These rise to dizzy heights at almost impossible gradients yet they are worked with safety and efficiency. In addition to various local lines, which are notably steep in places, there are many railways specially built for the benefit of visitors to the "playground of Europe." It is interesting that on some of these rack-and-pinion systems are in use, a development, in a sense, of the early Blenkinsop arrangement. Electricity supplies the motive power for many of these lines, but steam is still in use also.

The first rack mountain railway in Europe was the Rigi line starting from Vitznau on the shores of Lake Lucerne. This was under construction from 1869 to 1871. It is steam-operated and has a length of 4.38 miles and a maximum gradient of 1 in 5. The rack is arranged centrally between the running rails, and this rack is traversed by a cog-wheel mounted beneath the locomotive and driven from the engine cylinders. As will be seen from the upper photograph reproduced on the opposite page the steepness of the gradients is such that the locomotives are built "on the slope" so that the boiler will be maintained in a horizontal position when on gradients. This form of construction gives the engines a very curious appearance when they are seen on the level. For ascending the incline the engine pushes the passenger vehicle, and in descending runs before it, a practice that is customary on mountain railways of this kind. The average speed of the train is about 5 m.p.h.

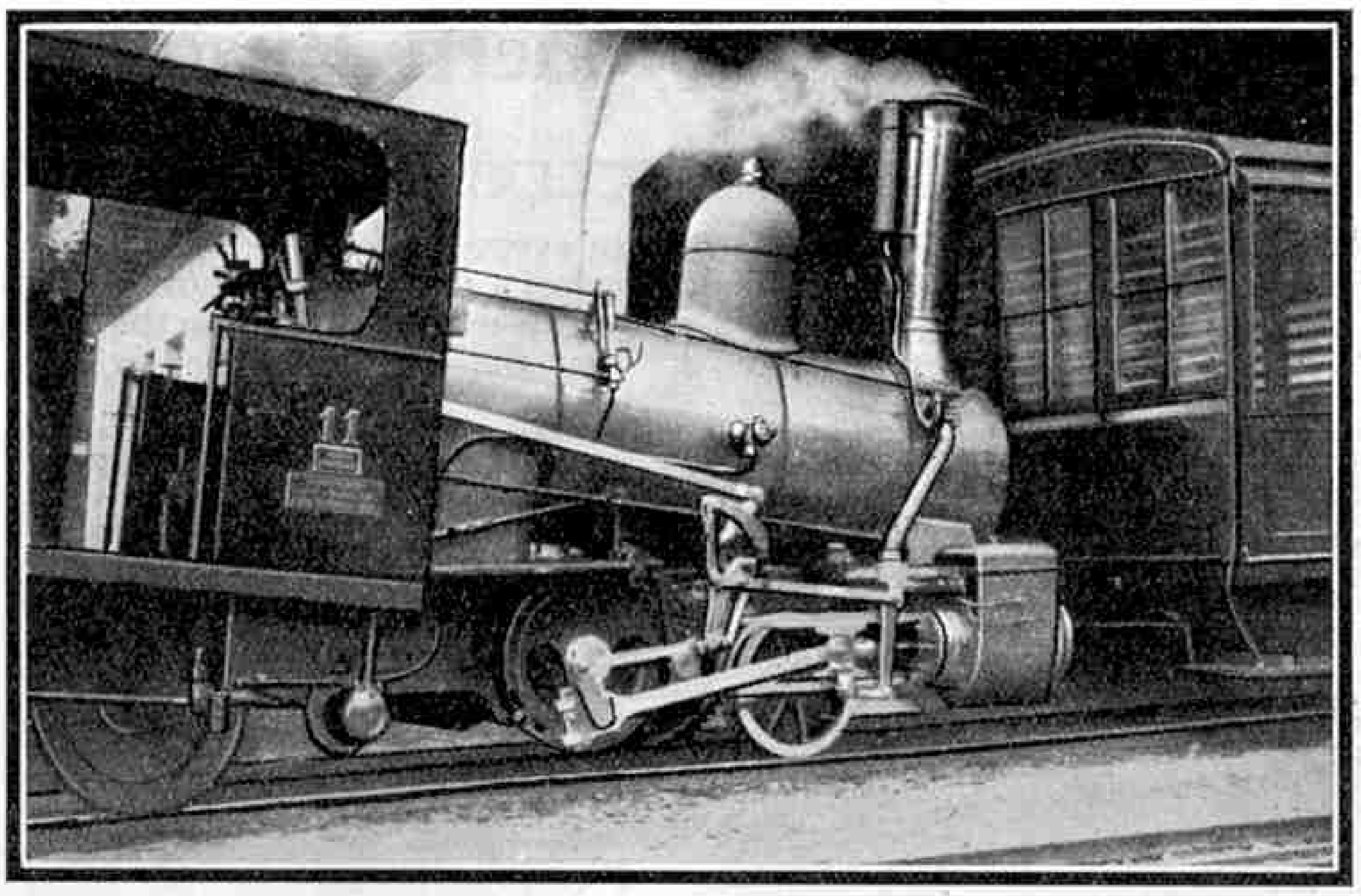
Remarkable views are obtained during the journey on this line, and from the summit. A curious illusion however that is borne on travellers making the journey for the first time is that, as the result of the inclination of the line and the special construction of the stock to allow for this, all objects observed from the train appear to be leaning at a dangerous angle! This is particularly marked on the downward trip.


A remarkable view on the electrically-operated Jungfrau mountain railway. This ascends to the highest railway station in Europe, 11,342 ft. above sea level.

After the establishment of the Vitznau-Rigi Railway numerous other mountain railway systems were constructed, one after the other. Of these the Arth-Rigi Railway up the other side of the mountain commenced in 1874. It is this railway, now electrically operated, that forms the subject of the cover illustration to this issue of the "*M.M.*" The starting point of this railway, Arth-Goldau, is a junction where important connections are made.

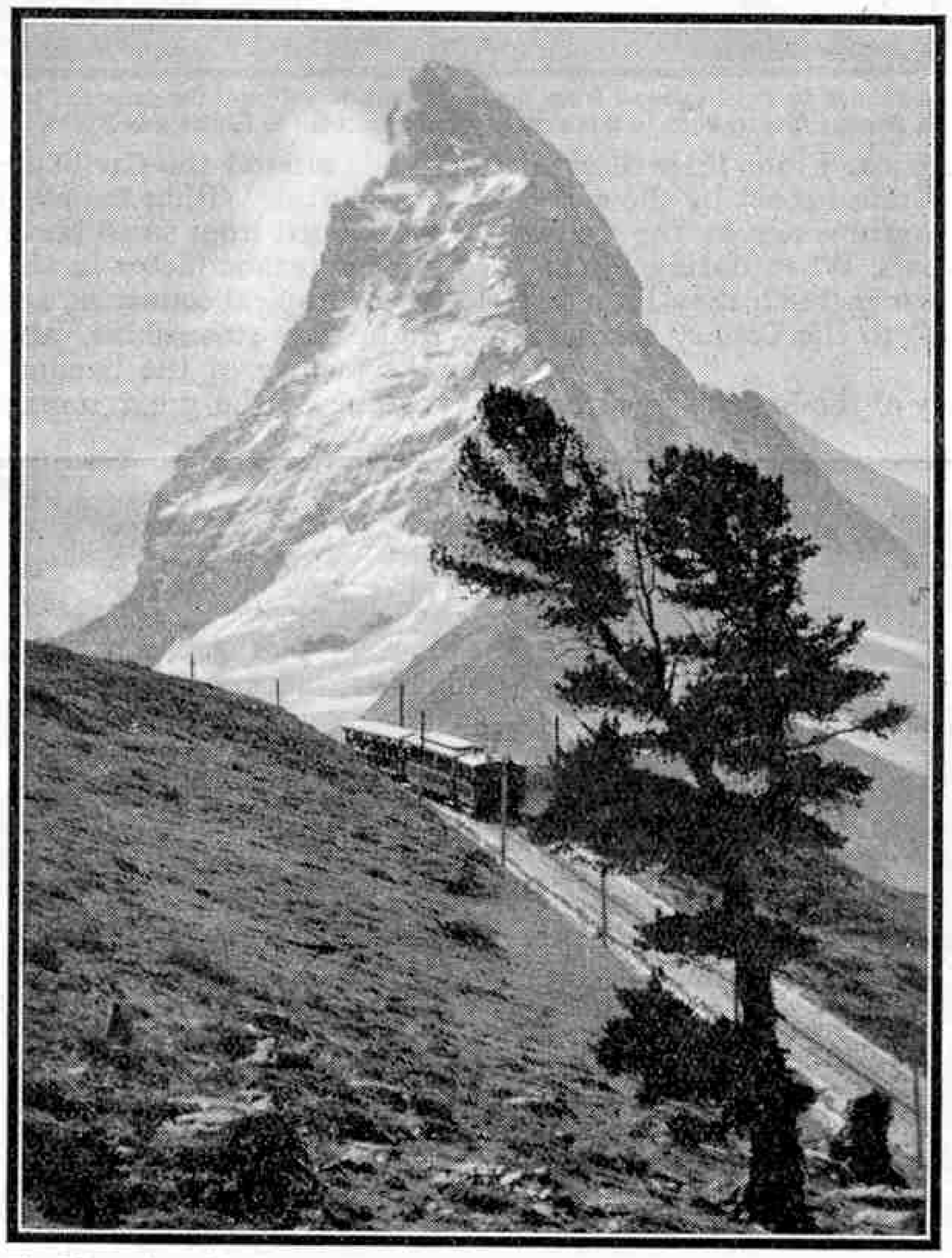
A remarkable system is that laid from Alpnachstad up Mount Pilatus. The maximum gradient of this is 1 in 2 and it climbs to a height of 6,791 ft. above sea level. Its construction was begun in 1886 and it was completed in 400 working days. Italian workmen, who built the road, frequently worked while suspended at the end of ropes. Even now the railway is carried at points on the narrowest of ledges, with little room to spare for the men engaged in permanent way maintenance. The permanent way is of very robust construction and the rails are secured to granite blocks cemented into the mountain side. The adoption of a special form of rack rail alone made possible the building of the line. The rack is double and is laid with its toothed projections horizontal. Thus the cogwheels on the trains are arranged horizontally also. A special design of steam-coach vehicle is employed on this railway, and in view of the extreme steepness of the gradients the boiler of the locomotive portion is arranged transversely across the vehicle, in order to secure a constant water level.

The mountain ascended by this line derives its name from the legend that the uneasy spirit of Pontius Pilate was condemned to haunt its peaks. As he was believed to cause thunderstorms when disturbed, ascent of the mountain was forbidden by the Government of Lucerne in the 16th century!



One of the steam locomotives of the Vitznau-Rigi rack railway. This is specially constructed, in order to keep the boiler horizontal and the cab vertical on the extremely steep gradients.

The highest railway in Europe is that up the Jungfrau, which reaches an altitude of 11,342 ft. It commences at the Little Scheidegg, itself 6,770 ft. high, and climbs to the Eiger Glacier station, a distance of 1¼ miles chiefly in the open. For much of the rest of the way the line is in tunnel, which of course protects the line from avalanches. The difficulties of construction were considerable as may be imagined. After the route had been determined, dumps of supplies had to be set on convenient mountain ledges. In order to ensure the progress of the work throughout the year, special attention had to be given to the stores established at Eiger Glacier, which formed the base of operations for the work proceeding beyond that point, owing to the fact that communication between it and the lower points was rendered impossible by snow falls.



The Matterhorn Peak and part of the Gornergrat Railway. This is an electric narrow gauge line operated on the rack system.

There are stations at Eigerwand and Eismeer, which also are part of the tunnel. At Eismeer giant "windows" are cut in one wall to afford a view. The upper terminus at Jungfraujoch is cut in solid rock and is the highest railway station in Europe. It is specially constructed to resist possible avalanches. This line is electrically operated, and numerous safety devices are in use. Automatic electric brakes are provided, but if the power current were to fail, current generated by the train running back would operate them.

A former steam-worked line, but now electrically operated, is that from Visp to Zermatt, a distance of 21¾ miles. This is interesting in that it is electrically operated with separate locomotives, and it forms a combined rack and adhesion system. Thus parts of the line are worked in the ordinary way by adhesion alone, and the maximum gradient here is 1 in 40. On the steepest sections, that are rack-operated, the maximum gradient is 1 in 8. Special attention has been given on this line to lightening the rolling stock. Welding is used extensively instead of riveting, and aluminium is employed wherever suitable.

From Zermatt runs the Gornergrat Railway. This is an electric narrow gauge line worked on the rack system. Leaving Zermatt it crosses a notable cantilever structure over the Findelenbach gorge, and climbs to a height of 10,140 ft. above sea level, with a maximum gradient of 1 in 5. Except for a few short tunnels the line is in the open all the way, and it is claimed to be the highest open-air railway in Europe. This is a motor-coach line, each coach being of 250 h.p. Three-phase current at a pressure of 700 volts is used and is generated in a hydro-electric power station.

Although a mountain railway, the Rhaetian Railway has no rack-operated sections. It is, however, a steeply-graded system for an adhesion line and is electrically operated, although originally opened in 1889 from Landquart to Klosters for steam operation. Other sections were added from time to time until the whole scheme was completed in 1913. The high cost of operation by steam, owing to the fact that all coal had to be imported, had in the meantime brought about the decision to adopt electricity for the last section from Bevers to Schuls. The scarcity and high price of fuel during the War brought about the final electrification. First the steeper portions were tackled and then the various sections remaining were dealt with simultaneously. By 1922 the whole system had been converted to electric working.

A line, which in conjunction with the Visp-Zermatt and the Rhaetian Railways forms part of the route of the *"Glacier Express,"* that runs from St. Moritz to Zermatt, is the Furka-Oberalp Railway. This is a steam line operated partly by rack and partly by adhesion. The steepest gradient on the rack section is in the neighbourhood of 1 in 10. The rack is double, consisting of two toothed members laid side by side between the running rails. Superheated tank locomotives of the 2–6–0 type are used. On the adhesion sections of the line the engine is propelled by the outside cylinders driving on to the cranks of the ordinary driving wheels, and it then operates as a simple expansion engine. On the rack sections, however, compound or double-expansion working commences, for the rack pinions between the frames are connected to inside low-pressure cylinders.

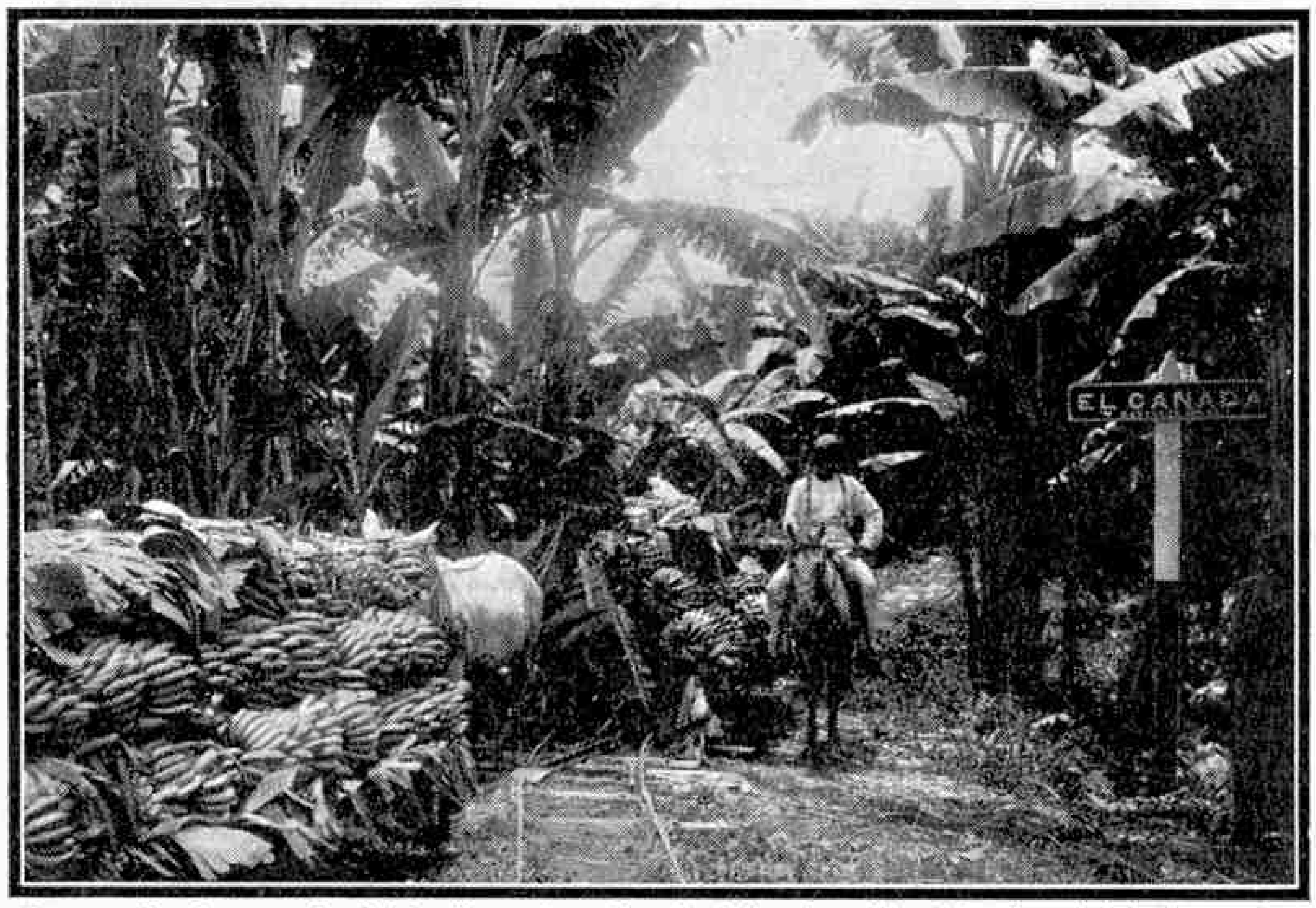
Spirally-constructed inclines were freely adopted in setting out the line, and the Furka Tunnel, 2,138 yds. long, is at an altitude of 7,120 ft., and is approached each way by stretches of rack-operated line over which low speed is the rule.

The Story of the Banana

A Romance of Modern Business

MANY fascinating stories can be told about our everyday foods, and one of the most interesting of these concerns the banana. The use of this fruit as a food for man is older than written history, and it has journeyed far and in its travels has been linked up with many thrilling adventures.

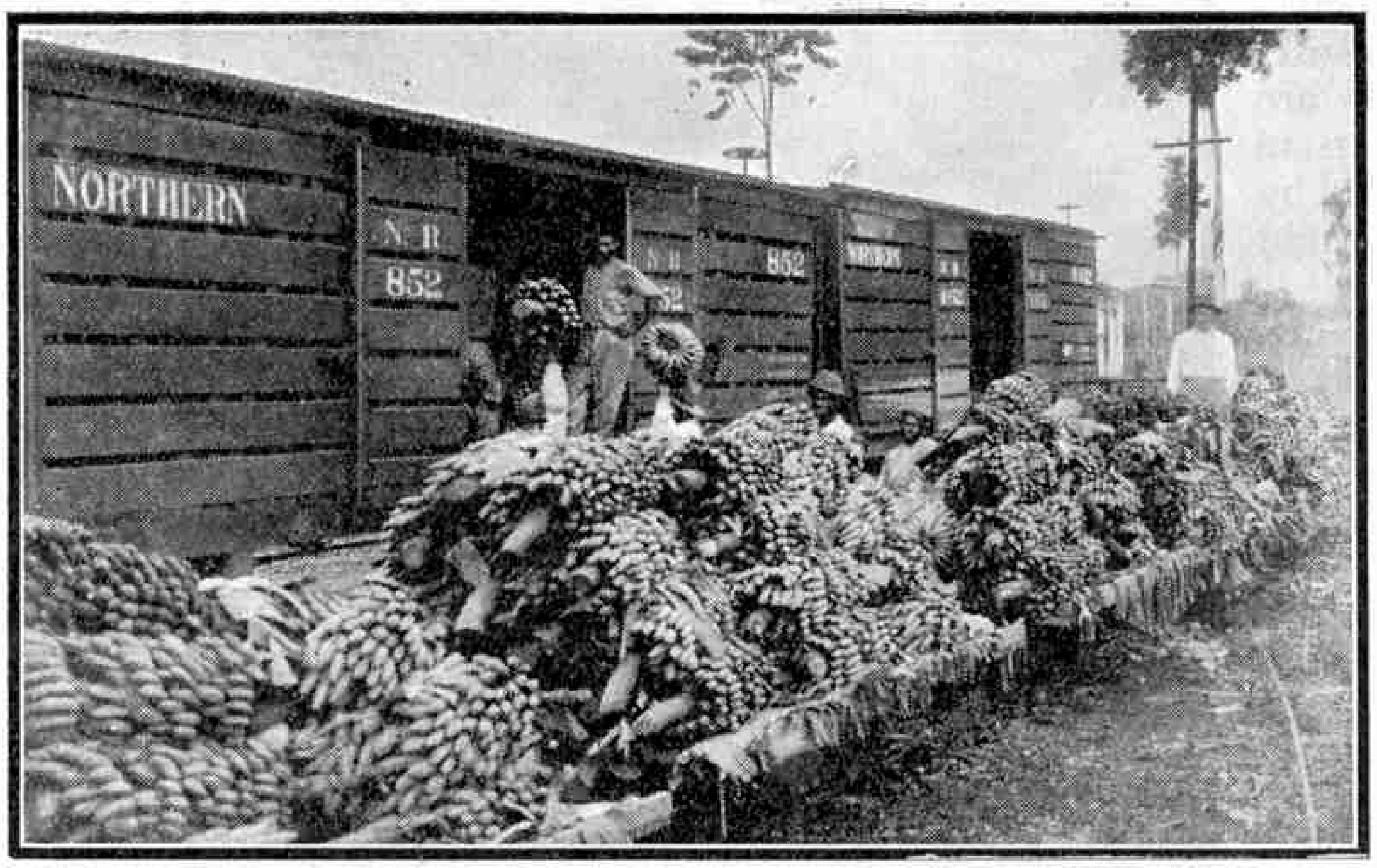
The earliest home of the banana is believed to have been the moist tropical regions of Southern Asia. We know that in 327 B.C. the armies of Alexander the Great found it flourishing in India and no doubt it was growing there centuries before he conquered that country. Because of an old tradition that the sages of India reposed in the shade of the plant and refreshed themselves with its fruit, the banana was called Musa Sapientum, or fruit of the wise men.



Transporting bananas by light railway from the plantation to railhead for despatch to the port of shipment. For the illustrations to this article we are indebted to Elders and Fyffes Limited.

The people of these ancient times found bananas so necessary that, when they went to make new homes in other lands, they carried dried roots along to be planted again. It is believed that in this manner the plant was taken from its original home to the eastern coast of Africa. From there it was probably carried westward across to the Guinea coast by the early Arabs, who were great traders. This journey across the Dark Continent no doubt took many, many years. When daring Portuguese explorers discovered the Guinea coast in 1482, they brought the plant and its African name "banana" to the Canary Islands, where they had established colonies.

The next great step in the world journey of the banana was from these islands, off the coast of Africa, across the Atlantic to the New World. The Reverend Father Tomas de Berlanga, a Spanish priest, went as a missionary to the Island of Santo Domingo in 1516, a few years after the famous voyages of discovery by Columbus, and carried with him some banana roots from the Canary Islands. Other missionaries to the New World followed his example and planted bananas in order that there should be no lack of food. The result was that in course of time the plant spread from Santo Domingo to the other islands of the Caribbean Sea and to the tropical mainland. Thus the banana had to go more than half way round the world to reach Jamaica and Central America, where it is now most widely cultivated.



Bunches of bananas being loaded at railhead, where the light railways on the plantation converge.

After bananas came into general use in the Tropics it was many years before they were found in the markets of the Temperate Zone. The reason was that sailing ships were too slow and unreliable; specially constructed steamships were needed to bring this delicate, perishable fruit to the peoples of Europe.

Bananas were practically unknown in this country 40 years ago, except as a rare tropical luxury. How different to-day, when people in every part of the British Isles are able to secure at reasonable prices a regular supply of this delicious fruit the whole year round.

It is in Jamaica and in the low coastal regions of Central America that the tropical jungle, swarming with chattering monkeys and brilliantly coloured parrots, has given way to the greatest banana farms in the world. For 300 years after Columbus came these sunny lands of Central America were the seat of the great Spanish Empire in the New World and they are rich in stories of Spanish conquerors and of buccaneers. What a world of history centres around Panama, for instance. There, centuries ago, caravans toiled wearily through the dense tropical jungle laden with gold bound for Spain. Drake and other famous Elizabethans raided the Spanish possessions in the New World and later Henry Morgan, a brave but cruel pirate, led more than 1,000 men to the sack of the city of Panama.

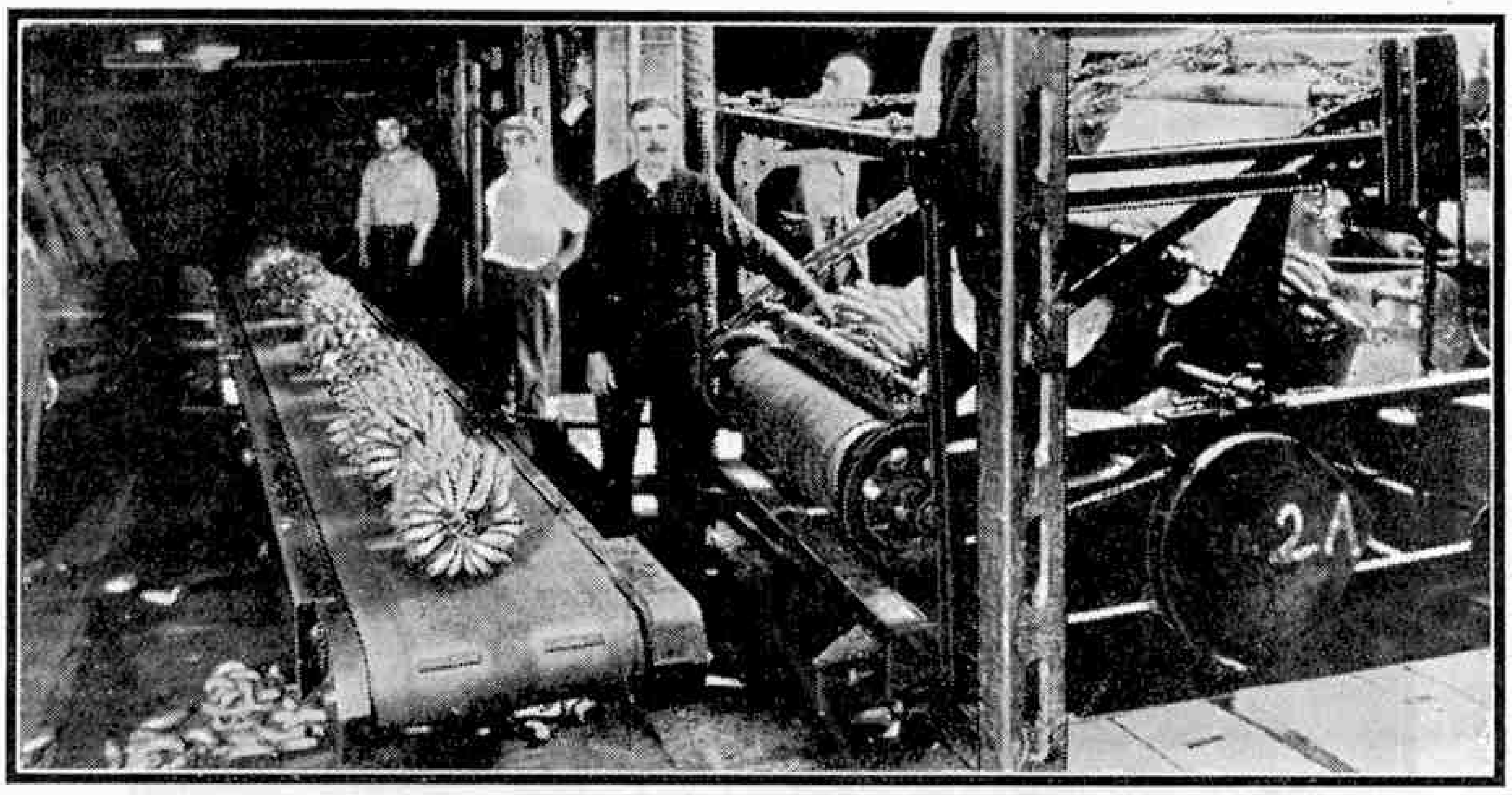
Interesting as are the stories of adventures that happened long ago in the lands around the Caribbean Sea, to-day's happenings are quite as wonderful. Within the memory of living man the banana trade has developed from small beginnings into a great industry. It has been an important factor in the promotion of health and sanitation in these tropical countries, and has been responsible for the creation of railroads, steamships, air and radio communications. In fact, the history of the banana industry can be described with truth as one of the great romances of modern business.

Jamaica, one of Britain's oldest colonies, is only about half the size of Wales. It is so well cultivated, however, that it stands second in banana production, and in 1935 more than 20 million bunches, or close upon 2,500,000,000 bananas, were shipped from the island, most of them to England.

The banana plant grows in an unusual way. When fully grown and ready to bear fruit, it is from 15 ft. to 30 ft. high and measures from 9 in. to 16 in. in diameter at its base. It is therefore very often called a tree. It is not a tree, however, because there is no wood in it, for the trunk, or main stem, is composed of thick leaves wrapped tightly together in overlapping layers. The plant develops rapidly and the new leaf sheaths growing at the centre of the stalk push the older ones outward and so enlarge the trunk.

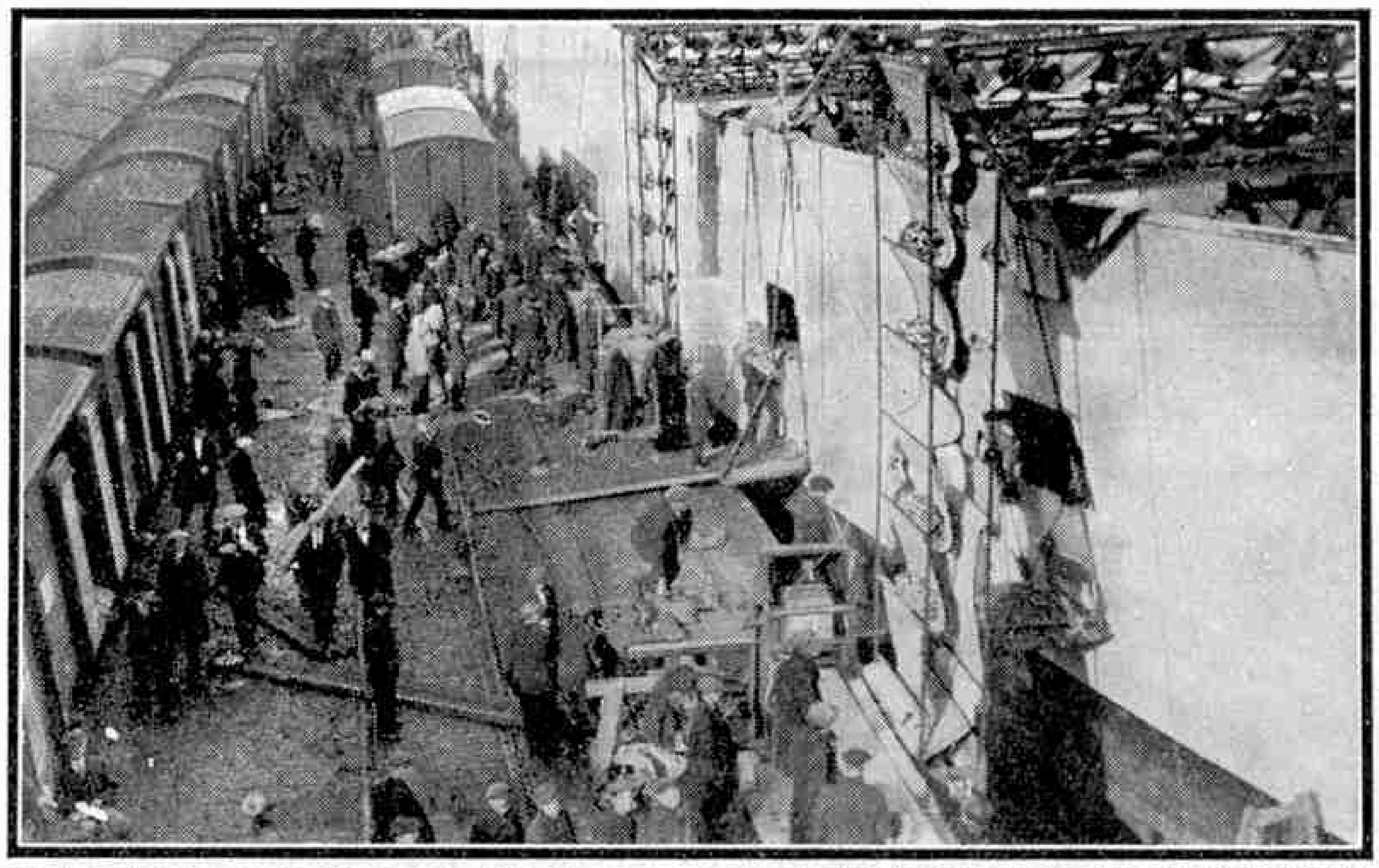
Each plant bears only a single bunch of bananas. After the fruit is harvested, the "tree" is cut down, when it quickly decays and enriches the soil. Several plants grow from the same mother root, or "mat," so that development of the bunches continues in steady rotation. The average annual banana production per acre is from 300 to 450 bunches, according to soil, climate, and the methods that are employed in the cultivation of the plant.

An astonishing variety of activities is necessary to establish banana production on a large scale. The first essential is that the jungle must be conquered. In creating a new plantation, the land has to be carefully chosen. It must be suitable for draining and fit for cultivation, and must be so located that the fruit to be produced can be conveyed by rail to a convenient port. There also must be a supply of labour on hand so that sufficient workers can be engaged. The site selected is surveyed and cleared of underbush, any heavy timber being left standing usually until after the planting. Drainage ditches are dug to carry off the water resulting from heavy rains, buildings are erected to shelter the workers and to house their supplies, and a hospital is built for the care of the sick. Railways are constructed to connect with the ports, and light, narrow railroads, called tramways, are laid to link up the different parts of the plantation with the main line. Telephone lines are strung and a wharf is built. Much of this work must be done, or at least definitely planned, before the next step of planting is started.


At the port of shipment the bananas are carried aboard by means of a conveyor belt system, as shown in this illustration.

When everything is ready, the cleared land is marked out so that the plants may be arranged in rows. Holes are dug about a foot deep and 14 ft. apart, and in each of them is put a piece of banana root, weighing three to four pounds. These "bits" are obtained by digging up roots of fully grown plants on other farms, and cutting them into proper sizes. Each "bit" that is planted must have one or more sprouts, or "eyes" like the eyes of a potato. Bananas can be planted in any month, which means that fruit is maturing constantly throughout the plantations.

Three or four weeks after the planting the first leaf appears above the ground and in the month that follows numerous shoots spring up from each of the "bits." The weak shoots are cut away and only the stronger allowed to grow, whilst some "bits" of course fail to grow at all. When this is the case, the vacant spots in the plantation are filled by setting out young plants, called "sword-suckers," brought from the neighbouring farms, this practice being known as "supplying." In a large measure the progress of the plantation depends on the success attending the original planting.


Discharging the cargo of a banana ship. Conveyors are used and the bunches are transferred directly from the ship to waiting trucks.

Before the young plants appear above the ground, the large trees are felled and it will readily be imagined that at this stage the plantation resembles a heavy forest devastated and laid flat in a confused mass, rather than a banana farm in the making. To the uninitiated it might appear that the felling of the trees on the newly-planted ground would destroy the young plants, but this is not the case, as the latter grow up around the fallen logs, which rot away in a few years. As the enormous quantity of felled forest growth decays, it covers the ground like a mulch and actually creates the most favourable conditions for the growth of the banana plant.

The banana tree blossoms nine or ten months after planting. The stem that is to bear the bunch grows up through the centre of the stalk and comes out at its top. Then it bends over and down, the flower bud at its end looking like a big ear of corn in its husk. It is not long before these husks drop off, and the young bunch can then be seen with all its tiny bananas pointing downward. As they grow, their points gradually turn outward and upward, and remain in that position until the bananas are fully developed.

The first bunch is ready for harvesting from 13 to 15 months after the planting. It is made up of clusters called "hands," each with from 10 to 20 bananas or "fingers." A bunch normally carries six to nine hands, and its weight varies between 30 lb. and 65 lb. Sometimes a bunch is produced with as many as 20 hands, or more than 300 separate bananas, but this is rare.

Life on the plantation consists of much more than just planting and harvesting bananas, for there is a continual round of work to be done throughout the year. Weeds and other tropical growth quickly spring up and it is necessary to give the farm its first "cleaning" three months after planting. This process, which is an expensive one, is repeated about every three months so that weeds may not choke out the young banana plants.

Apart from such problems as the cleaning and keeping up of the plantations, there are plenty of everyday tasks to be done. For instance, the thousands of cattle, horses and mules on the various farms have to be fed and cared for. Buildings, roads and bridges have to be kept in repair and schools erected for the children of the plantation workers. Stores must be kept well supplied with a wide range of articles to meet the everyday needs of people who live in the tropics; and the big drainage ditches must always be kept in order so as to prevent heavy rainstorms from washing away roads and bridges, or damaging the tramways and the railways.

There may be a long spell of dry weather during which bananas will suffer from lack of moisture. Again a high wind, such as that experienced in Jamaica in September 1935, may blow down millions of plants heavy with fruit ready for harvesting. When disasters like these occur, months of work may be needed to put the plantations in working order once again.

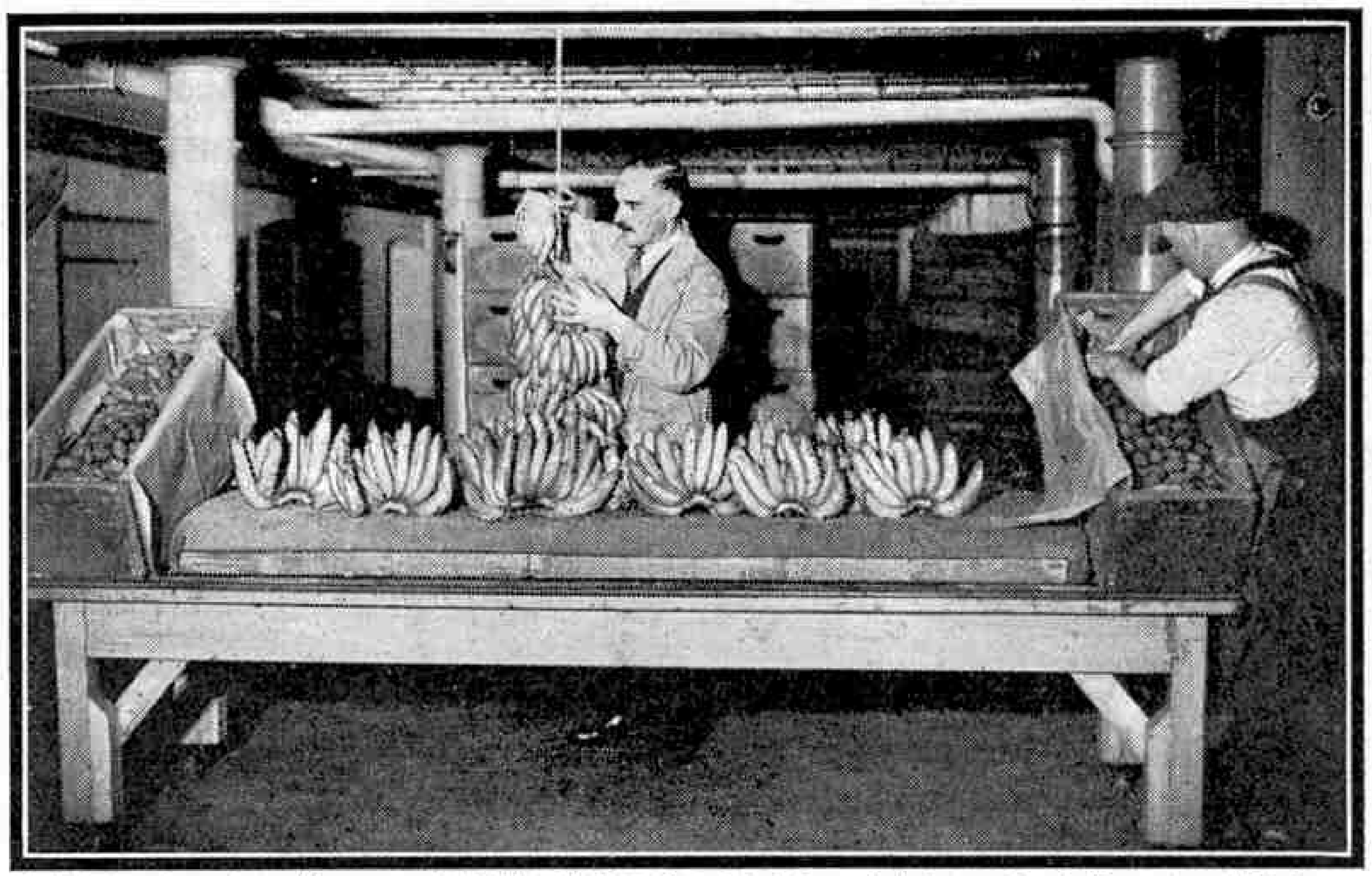
Even when the fruit is to be eaten in the tropics, it is not allowed to ripen on the plant. If it does, it is likely to burst open, attract insects, and acquire rather an unpleasant taste. The finest flavour is developed only when the fruit is cut green from the plant and ripened afterwards; bananas therefore are harvested in a green condition. Great care is necessary in choosing the proper grade of fruit to be cut, for if too thin the bananas are not mature, whilst if too full they are liable to bruise before reaching the English market.

The "cutting gang" begins work at daylight on the day of a steamer's arrival in port. Each unit consists of a cutter, a backer and a mule man. A cutter, using a knife on the end of a long pole, cuts the plant a few feet below the bunch. As the plant bends, he steadies it with his pole so that the bunch may swing down easily and come to rest on the shoulder of the backer, who is waiting to receive it. Then the cutter with a long sword-like knife called a machette chops the bunch from the stalk and the backer carries it to the nearest road or tramway, where it is loaded either on to a pack mule or on to one of the little tramcars that run to almost every part of the plantation. The fruit then is carried to the main railroad, where the bunches are transferred to waiting trucks under the watchful eyes of the inspectors, who reject any that are imperfect.

Banana farming calls for a lot of intricate work, but the greatest problem of the industry perhaps is the need for getting the fruit quickly from the plantations across 5,000 miles of ocean to the ripening rooms of the wholesale fruit merchants at various centres throughout the British Isles.

When a wireless message is received at a tropical loading port such as Kingston, Jamaica, stating that a certain ship will be ready to take 100,000 bunches of bananas on a particular day, the men in charge know which farms are ready to supply the fruit. All the cutting orders are given well in advance, and the foreman of each farm knows just how many bunches he is expected to contribute to that particular cargo. As bananas are so perishable it is important to have the fruit available at the tropical port immediately the ship is ready to load.

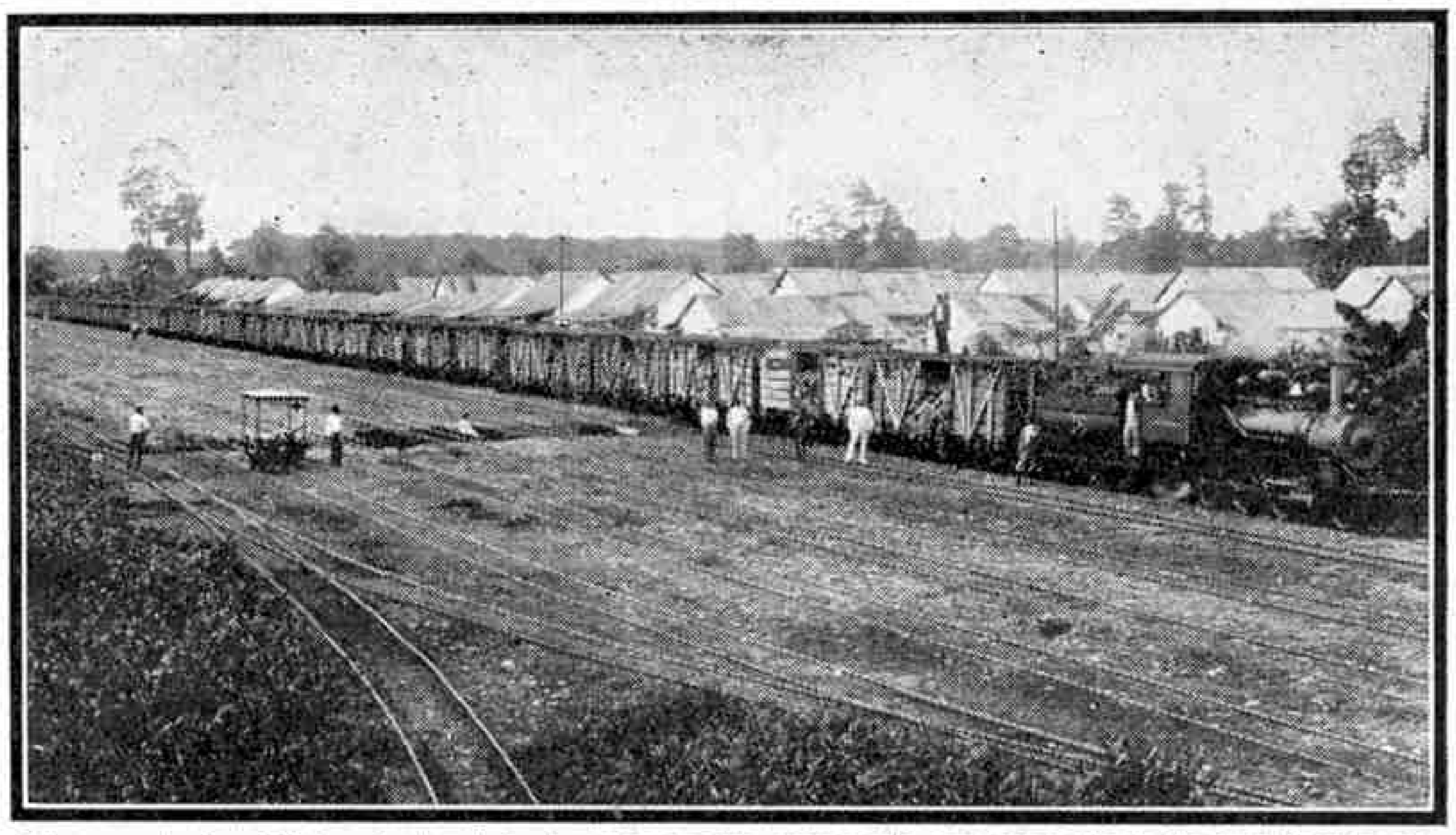
Upon reaching the wharf, the banana train is moved into position alongside the steamer and a gang of labourers transfer the fruit expeditiously to the loading machines or conveyors, which consist of an endless chain of canvas pockets. They carry the bunches one by one over the side of the ship and into the holds below, where experienced workers carefully stow them. All this is performed under the closest inspection and any damaged bananas are not allowed to be shipped. A cargo of 100,000 bunches can be put aboard in about 18 hrs.



Cutting up bunches of bananas into "hands" and packing these into boxes for delivery to retail shops.

Bunches of bananas are not packed for shipment; they travel exactly as they are harvested in the tropics. The holds of all banana-carrying steamers are divided into several "decks," each partitioned into a number of compartments or "bins" of convenient size in which the fruit is stacked. These bins, which are constructed of wooden bars, similar to the "old farm gate," keep the bunches from shifting and becoming bruised in transit, and so ensure that the fruit will reach Great Britain in good condition.

At an early stage of the investigation into the transport of bananas across this 5,000 mile stretch of ocean, it was found that if the holds of the banana ships could be kept from getting too hot or too cold, and if they could be supplied with plenty of fresh air, the fruit could be carried in good condition at all times of the year. In the early days ventilators kept fresh air flowing through the holds of the ship, but modern vessels engaged in the trade have wonderful machinery, specially planned, to take care of their cargoes. Great refrigerating machines cool the holds before the fruit is loaded, and all the time during the voyage home they keep the air around the bananas at exactly the right temperature. Big fans keep cooled, fresh air circulating all the time around the fruit, and every few hours, day and night throughout the voyage, visits are paid to the holds of the ship to see that both air and temperature are as they should be. The refrigerating machines have to be very powerful, as bananas are not only fairly warm when loaded but actually give out heat during the voyage.



A banana train of 40 trucks leaving a junction on the way to the port from which the fruit is shipped.

It will be seen that the departure of a steamer for this country is by no means a signal for relaxed attention in the care of the fruit, which must be landed on this side in the same green condition as when it was harvested. Immediately upon the arrival of the steamer at the home port the quays are cleared and railway trucks are marshalled, for more than 500 specially constructed banana vans are needed to transport a full cargo by rail. Within a few minutes the fruit is being discharged from electrically-operated elevators to conveyors, and so into the trucks at the rate of no less than 8,000 bunches per hour; and fast trains leave with these banana vans for all towns in Great Britain. Upon arrival at the warehouses of the wholesale fruiterers the bananas are hung in specially constructed ripening rooms that reproduce tropical conditions exactly. The fruit is carefully ripened for five to six days, cut up into "hands," labelled with the familiar "Blue Label" and distributed to the retail shop. At every stage of their journey from the tropics to the table care is exercised to see that the bananas reach the consumer perfect in condition and mellow in flavour.

Bananas are sealed by nature in a glove-like, germ-proof skin that keeps out all dust and dirt. This makes them one of the safest, freshest and cleanest foods to eat. Like other fresh fruits, bananas should be eaten when they are fully ripe. When they are green, they contain a large percentage of starch, like an uncooked potato. During the process of ripening the starch is changed into fruit sugar, or natural glucose, which can be assimilated by the most delicate digestion. The extraordinary value to health of glucose, and the remarkable rapidity—only a matter of seconds—with which it supplies the human system with energy, are nowadays fully appreciated.

The impression still lingering in some minds that the banana is an indigestible fruit is quite fallacious. Although it is true that the banana, just like the apple, the pear, or the melon, is indigestible in its unripe form, when it is allowed to ripen, it is not only very digestible, but one of the most quickly and easily digested of all fruits. Indeed, a ripe banana, mashed and sieved, is one of the first solid foods nowadays given to infants by many doctors.

It is well to remember that yellow bananas with green tips are not yet ripe. The skin turns to a bright yellow in ripening, and all the green fades away, even from the tips. In another day or two brown spots appear on the golden-yellow peel and the pulp becomes softer and more mellow. At this stage, bananas are fully ripe. The fruit is then sugary sweet and the flavour is at its best. In this state they are fully digested in 1¾ hrs. as compared with 2½ hrs. for apples, 2¾ hrs. for oranges, 3½ hrs. for boiled potatoes, and 3¾ hrs. for plums.

The banana is one of the fruits that ripen after plucking, so that it is by no means necessary that bananas shall be fully ripe when they are purchased in the shops. They need only be kept in the home for a day or two for all trace of green to disappear from the skin, and thus indicate that the fruit inside is ripe and perfectly digestible.

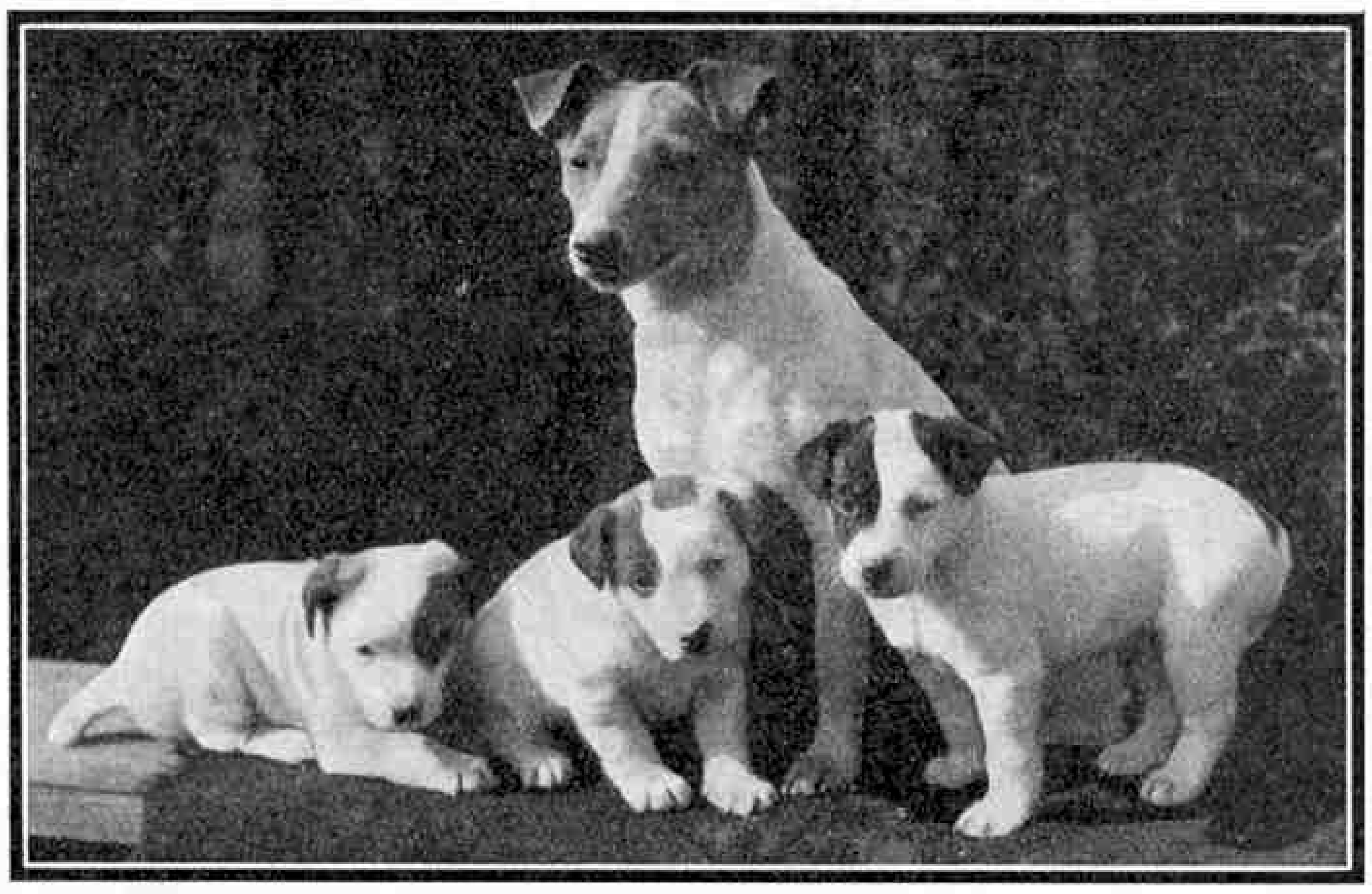
Many people prefer to let the banana ripen still further until the outer skin begins to turn brown. In this condition the flavour of the pulp inside has developed to its highest delicacy and greater digestibility. It is wrong to put bananas not yet ripe into a cool place—a mistake that many people make—because a cold atmosphere keeps them from ripening properly and impairs their fine, natural flavour.

A Spanish friar travelling in the West Indies soon after the discovery of those islands hazarded the guess that the banana plant was the tree of life. In one way his suggestion was a good one. The banana is richer in proteins, or tissue-forming foods, in fat and in carbohydrates, which produce heat and muscle energy, than either the apple or the orange, and in addition to glucose and other beneficial constituents it contains the vitamins and mineral salts needed to protect our health and to build strong bones and teeth. It is therefore a protective food, and a ripe banana, which contains a large proportion of carbohydrates, and a glass of milk, rich in proteins, together make an ideally balanced ration. Bananas for the most part are just peeled and eaten in the simplest way, and that is why they are liked and used so much for picnics and on motor or train trips.

We are indebted to Elders and Fyffes Ltd. for the information given in this article.

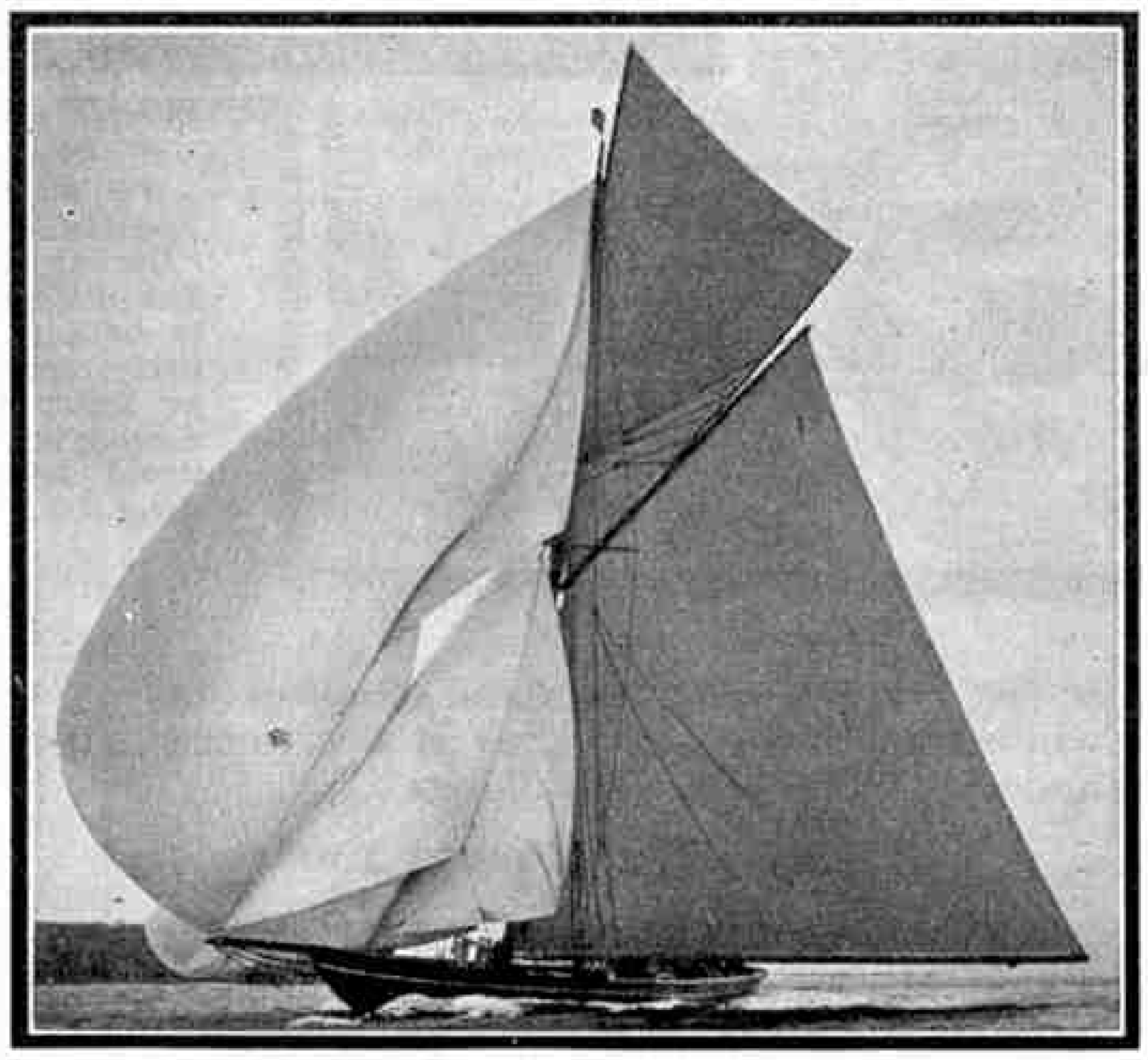
HOLIDAYS AND THE CAMERA

AT this time of the year cameras of all kinds, new and old, make their appearance in surprising numbers. It is almost certain that more photographs are taken between June and September than during the remaining eight months of the year put together. This is the great holiday period, and no holiday is really complete without a camera. The range of possibilities within reach of even a novice with the cheapest form of camera is almost unlimited. The owner of a camera is able to bring home at the end of a holiday a record that is not only permanent, but actually grows in interest as time goes on. Without such a photographic record the memories of even the most enjoyable and interesting holiday become dimmer and dimmer, and finally fade away.



A fine photograph of a dog family. This illustrates how it is possible, by careful arrangement of lighting, to suggest the actual texture of the animals' coats. For this photograph and the one below we are indebted to the courtesy of Ilford Ltd.

Those who possess cameras that have been laid by for some time should make sure that these are in good working order before they take them away on a holiday. Nothing is more irritating and disappointing to the amateur than to take a series of holiday snapshots and then find, when it is too late, that they are all spoiled because the camera was not light-tight, or the shutter was not working properly. The best plan is to expose a film and have it developed and printed. Then any defect in the camera is easily seen. and can be quickly remedied.



Yachting scenes provide splendid material for snapshots.

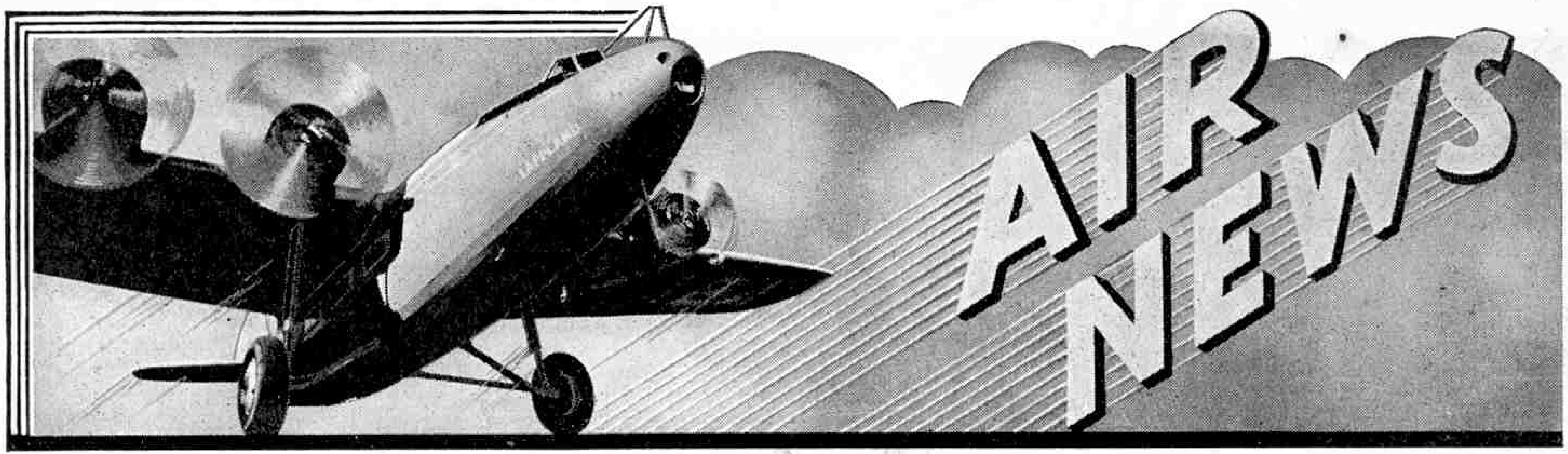
Cameras and photographic materials of all kinds are now so reliable and simple to use that no one should have any difficulty in securing a good series of holiday records. The failures that occur are almost always due to attempting impossibilities. The most important point to remember is that successful snapshots require a reasonably good light. It is little use to attempt them late in the evening, or during the day when the sky is overcast with dark clouds. The best advice that can be given to a beginner is to spend 1/6 on the "Wellcome" Photographic Handbook. This contains an exposure calculator that makes it the simplest possible matter to ascertain quickly whether the conditions at any moment are suitable for snapshots. In addition to the calculator the handbook is full of useful and interesting advice on almost every branch of photography, both indoors and outdoors.

Another thing that the beginner in photography must always bear in mind is that close-up photographs of rapidly moving objects cannot be taken with the average cheap camera. The fastest shutter speed of such a camera is generally about 1/25 or 1/30 of a second, and this is far too slow for any rapid movement at close quarters. Fairly good snapshots of objects moving at only a moderate speed may be secured with such shutters if the photographer stands well away from the object. Of course the resulting pictures will be very small, but they should be sufficiently sharp to allow of considerable enlargement.

Many cheap cameras are of what is known as the "fixed focus" type; that is to say they are not provided with any means of focussing objects at different distances. Such cameras are perfectly successful for general views of any kind, but they cannot be used for near subjects such as head-and-shoulder portraits. This difficulty is overcome by placing in front of the lens what is known as a "portrait attachment," which automatically brings into sharp focus objects that are only three or four feet away from the camera. Such attachments, which consist of a lens mounted so that it can be slipped over the regular lens, may be obtained cheaply for most small cameras.

The majority of cheap cameras are provided with a "view finder" to show the extent of the picture that will appear on the film. This finder usually consists of a tiny lens that throws on to a mirror a miniature reproduction of the view. This type of finder is not absolutely accurate, and if a certain object that it is desired to include in the photograph is seen to come close up to the edge of the finder image, it is not safe to assume that this will appear as it is wanted on the film. In such a case it is best to move slightly further away, so as to bring the object more into the centre of the finder image and thus allow for a margin of error. The camera should be held so that the eye looks directly down on to the finder mirror.

In making the exposure the camera must be held quite steady. To the average person it is practically impossible to do this for more than about 1/15 of a second; and if a longer exposure is necessary the camera must be placed on a tripod, or on a convenient wall, fence or other solid support. Another important point is to press the shutter release gently and steadily in order to avoid jerking the camera at the moment of exposure.



Air Liners at Croydon

Visitors to Croydon Airport always find much to interest them, and one of the most fascinating sights is the departure of a large Imperial Airways or foreign air liner employed on one of the many regular air services. The photographs on this page were taken by an "*M.M.*" reader, F. H. Done, of Northwich, during a recent visit to Croydon. They illustrate successive stages in the departure of "*Horatius*," one of Imperial Airways aircraft working on the company's European services.

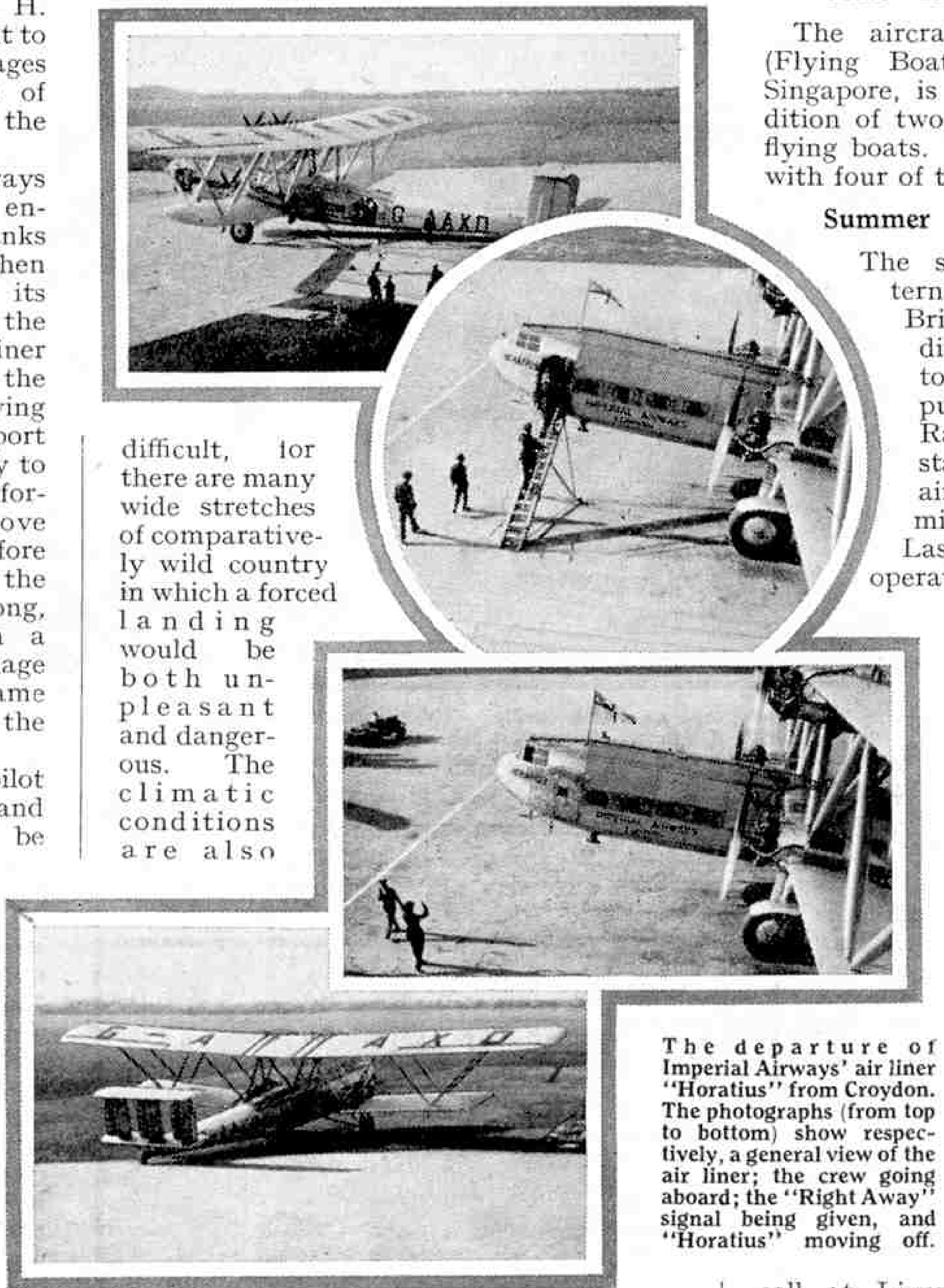
Before each flight an Imperial Airways air liner is completely overhauled, the engines are tuned up and the petrol tanks refilled. An industrious little tractor then tows the aeroplane tail first from its position outside the hangars back to the embarking area. The towing of an air liner with such a large wing span as the *Horatius*" has to be done slowly. Leaving "*Horatius*" standing in front of the airport booking offices, the tractor hurries away to attend to some other machine. The forward part of the great air liner is high above the ground, and a gangway is therefore fixed in position to give access to the cockpit. The passengers enter the long, luxuriously furnished cabin through a doorway in the rear portion of the fuselage and close to the ground; and at the same time the mails are loaded into one of the freight compartments.

Shortly afterwards the assistant pilot ascends the gangway to the cockpit, and starts the engines so that they will be already "warmed up" when the moment comes to take off. As the scheduled time for departure draws near the crew stand by the machine. Periodically the pilot glances at his watch, and eventually he climbs the gangway, the other members of the crew follow, the cockpit door is closed and the ground staff wheel away the gangway. The "right away" signal is given by an airport officer, and with a roar the engines spring into life, the wings vibrating under the strain. A last hand wave to the ground staff, the ensign is drawn in and the air liner moves slowly forward. Wheeling round to the right so as to be facing the wind it taxies across the landing ground with rapidly increasing speed, and after a take-off run that seems amazingly short for such a huge machine, it rises into the air and soon disappears from view in the direction of France.

Good Service by Bristol "Bulldogs"

The 12 Bristol "Bulldog" single-seater fighters bought by the Esthonian Government in 1931 are still in service, and although each has made more than 1,000 landings, the only repairs of any consequence that have been necessary were to two machines that were damaged through bad landings. One of them had to be fitted with a new tail-end to the fuselage, and the other with a new airscrew and axle.

Operating conditions in Esthonia are difficult, for there are many wide stretches of comparatively wild country in which a forced landing would be both unpleasant and dangerous. The climatic conditions are also severe, and the snow-bound country in winter makes it necessary to fit skis to the undercarriages of the "Bulldogs."


The departure of Imperial Airways' air liner "Horatius" from Croydon. The photographs (from top to bottom) show respectively, a general view of the air liner; the crew going aboard; the "Right Away" signal being given, and "Horatius" moving off.

Speeding up U.S. Air Freight Traffic

Pan-American Airways and about 20 other air line organisations in America have joined forces in a unified air express system which has made possible important accelerations in the transport of urgent freight. These air interests have also arranged with certain ground service organisations for an express door-to-door pick-up and delivery service, and as a result the movement of loads between cities and aerodromes has been greatly speeded up. The new system provides an improved air express service to more than 200 cities in the United States and Canada.

More "Singapore IIIs" for R.A.F.

The aircraft equipment of No. 205 (Flying Boat) Squadron, stationed at Singapore, is to be increased by the addition of two more Short "Singapore III" flying boats. This Squadron was supplied with four of this type of aircraft last year.

Summer Internal Air Services

The steady development of internal air services in Great Britain is reflected in the additional services and extensions to existing ones that are being put into operation this summer. Railway Air Services, for instance, are operating 62 regular air services, with a total route mileage of just over 1,000,000. Last year 42 daily services were operated by this company, the route mileage then amounting to about 600,000.

In addition to their Royal Mail service between London, Birmingham, Liverpool, Stoke-on-Trent, Belfast and Glasgow, and a service between Belfast and the Isle of Man, R.A.S. are running an afternoon service from Manchester and Liverpool to Belfast, serving Northern Ireland, which is also linked by air with Glasgow by two services daily. Possibilities of a further Scottish air service, to link Glasgow with Perth and Inverness, are being investigated.

The North to South service starts from Barton Airport, Manchester, and terminates at Brighton Airport, as last year. The aeroplanes call at Liverpool, Birmingham, Bristol, Southampton and Ryde, Isle of Wight, on the way. There are two flights daily in each direction, one in the morning and the other in the afternoon, and the total time for the full journey, including stops, is 2 hr. 35 min. Ryde is the terminus of services from Cowes, Portsmouth, Gatwick and Brighton. In the other direction Gatwick is used as the London terminus airport of the Isle of Wight services, being connected with Victoria station by fast Southern electric train services.

Highland Airways are operating their

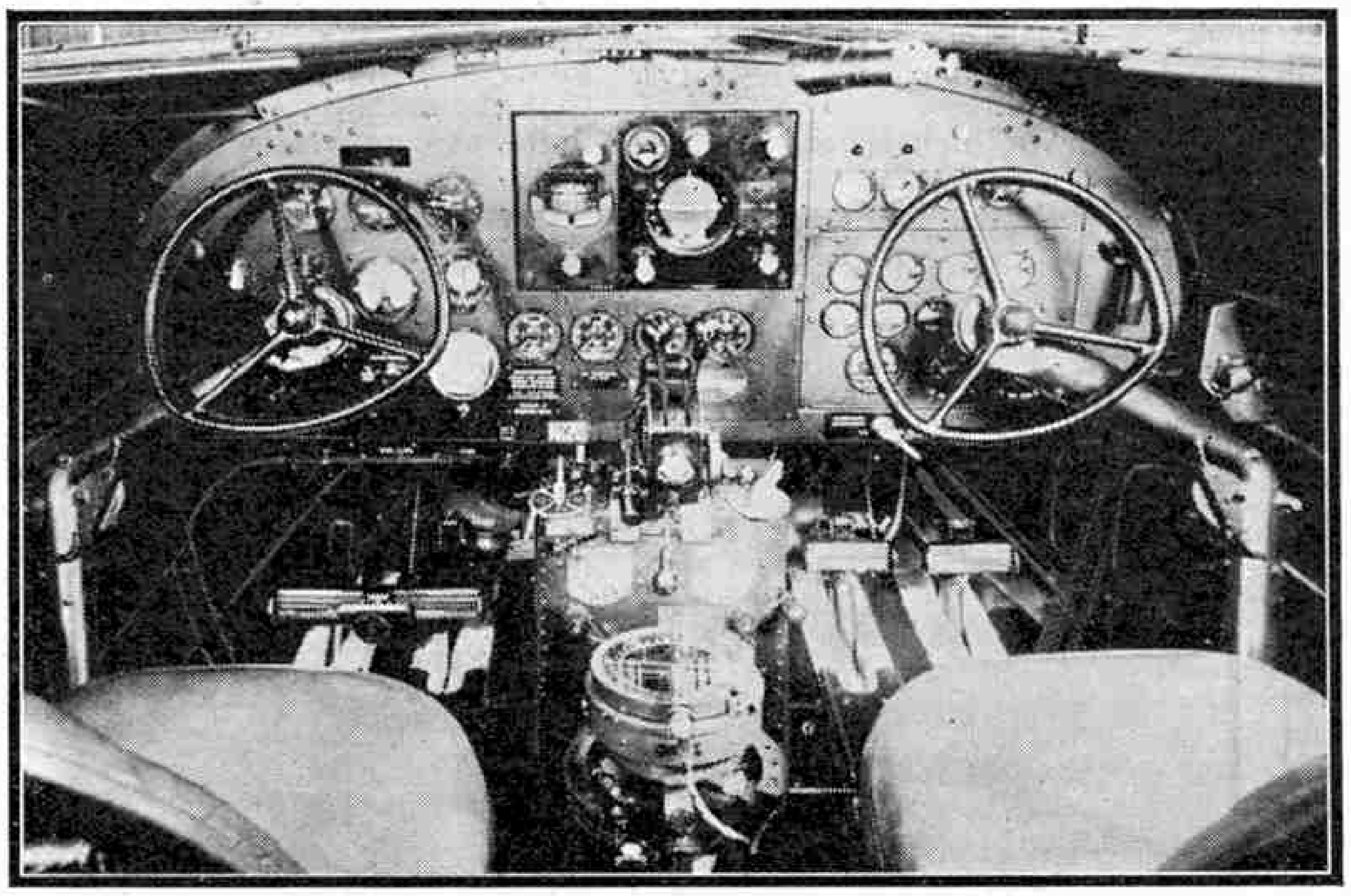
Aberdeen-Kirkwall air service again this summer, and by the time these notes appear in print they will probably have extended it to Shetland. The opening of this further section only awaits the completion of the wireless station at Sumburgh, Shetland. The extended service will be flown on Mondays, Wednesdays and Fridays until the end of this month, the flights terminating at Kirkwall on other days. A daily service over the whole route will be flown during July and August, the peak months of the summer air traffic.

One of the Fokker F.XXIIs owned by Royal Dutch Airlines, more familiarly known as the K.L.M. It is a four-engined machine with seating for 22 passengers. Photograph by courtesy of N. V. Nederlandsche Vliegtuigenfabriek, Amsterdam.

"Finishing" School for Imperial Airways Pilots

The giant flying boats and monoplanes now being built for the Empire services of Imperial Airways will, when in operation, be flying night and day. Not only will crews have to be provided for these machines, but the men who handle them will require to be both skilled pilots and experienced in navigation and wireless. It will also be necessary for them to be qualified in such matters as ground engineering and the maintenance and overhaul of the aircraft.

Imperial Airways have therefore started a "finishing" school close to the Croydon Airport. This school is being attended by 70 men who are already qualified pilots and hold official licences as commercial airmen, and have spent long periods in the air. The pilots leave their classrooms at various stages of their tuition and carry out practical experiments in wireless in special test rooms. They also go over to the big repair sheds at the airport, so as to learn at first-hand of airway engineering in its everyday aspects. Another interesting branch of the tuition made necessary by the big expansion scheme lies in training landplane pilots to handle big flying boats. This is being done at Hamble, near Southampton, where triple-engined "Calcutta" flying boats are being used for instruction purposes.


The cockpit of a Douglas D.C.2 "Transport" Monoplane, showing the dual control equipment, including the two pairs of foot pedals for operating the rudder bar. Photo. by A. J. Kouyoumjian, Baghdad.

It probably takes a pilot 12 to 15 months to pass through all the various classes of the finishing school. Then, when he has absorbed all this specialised instruction, he is not only an expert in flying and controlling modern air liners, but he has gained a grasp of navigation that includes meteorology, wireless, and airway engineering that will prove invaluable to him in his routine work on the Imperial air routes.

D.H. "Dragon Rapides" for Abroad

The high standard of de Havilland aircraft continues to be appreciated abroad. The Imperial Iranian War Ministry recently ordered three D.H. "Dragon Rapides," each seating five passengers, for use on several internal air lines one termini of which will be Teheran; and Aeroput, the Yugoslavian air transport company, have ordered a similar machine, the cabin of which will be arranged to seat eight passengers. The Adelaide Steamship Company have acquired two "Dragon Rapides" of the eight-seater type, and they will be employed by the subsidiary company, Adelaide Airways, on internal air services.

More D.H. "Dragon Rapides" are also to be employed on British internal air services this summer, and six machines of this type have been bought by Railway Air Services, who have also purchased two D.H. 86A Express Air Liners. When the new aeroplanes are in service they will bring the company's fleet up to a total of 18 machines.

Soviet Air Force Progress

The number of military air pilots trained in Russia last year was 3,500, and a further 8,000 will be trained during 1936. The great importance attached by the military authorities to gliding is shown by the fact that by the end of last year 52,000 men had learned to glide. At one recent demonstration five gliders were towed by a military aeroplane to a height of 10,300 ft. and were then cast off. They landed safely at an aerodrome where, very appropriately, a glider rally was being held.

Reports of the present strength of the Soviet Air Force are conflicting. Apparently the total number of military aircraft in service is just over 3,000, of which about 1,000 are observation aeroplanes, 1,000 are pursuit aeroplanes, 700 are bombing aircraft and the remainder are fighters of various types.

The Growth of Empire Air Services

In 1932 the route mileage of the Imperial air routes was only 8,320. To-day the mileage of the air routes operated by Imperial Airways and its associated companies totals approximately 26,000, and when all the new Empire services are in operation this figure will be increased to just over 40,000. At the present time the aircraft of Imperial Airways are flying an average of 17,000 miles a day.

Hard-Working Aero Engine Pistons

Strange as it may appear, it is nevertheless a fact that during a flight from Brisbane to Singapore the pistons in the four engines of a Qantas Empire Airways D.H.86 air liner travel a considerably greater distance than the 4,361 miles that separate those two cities!

Readers who are mathematically inclined can easily verify this statement, from the following details. The stroke of the piston is 5.512 in. During each revolution the piston moves once up and once down the cylinder, a total distance of 11.024 in. The four engines each have six cylinders, and the normal revolutions in flight are 1,900 per min. During one minute of flight the 24 pistons therefore travel a total distance of 502,694.4 in., or, to simplify the solution, a distance of 41,891.2 ft. The average flying time for Qantas air liners between Brisbane and Singapore is 33 hr., or 1,980 min. By multiplying 41,891.2 by 1,980 we arrive at 82,944,180 ft., which is the distance travelled by the pistons of the four engines of a Qantas air liner flying from Brisbane to Singapore. In other words, the pistons travel 15,709 miles 352 yd., while the air liner travels 4,361 miles.

New Junkers Machines for South Africa

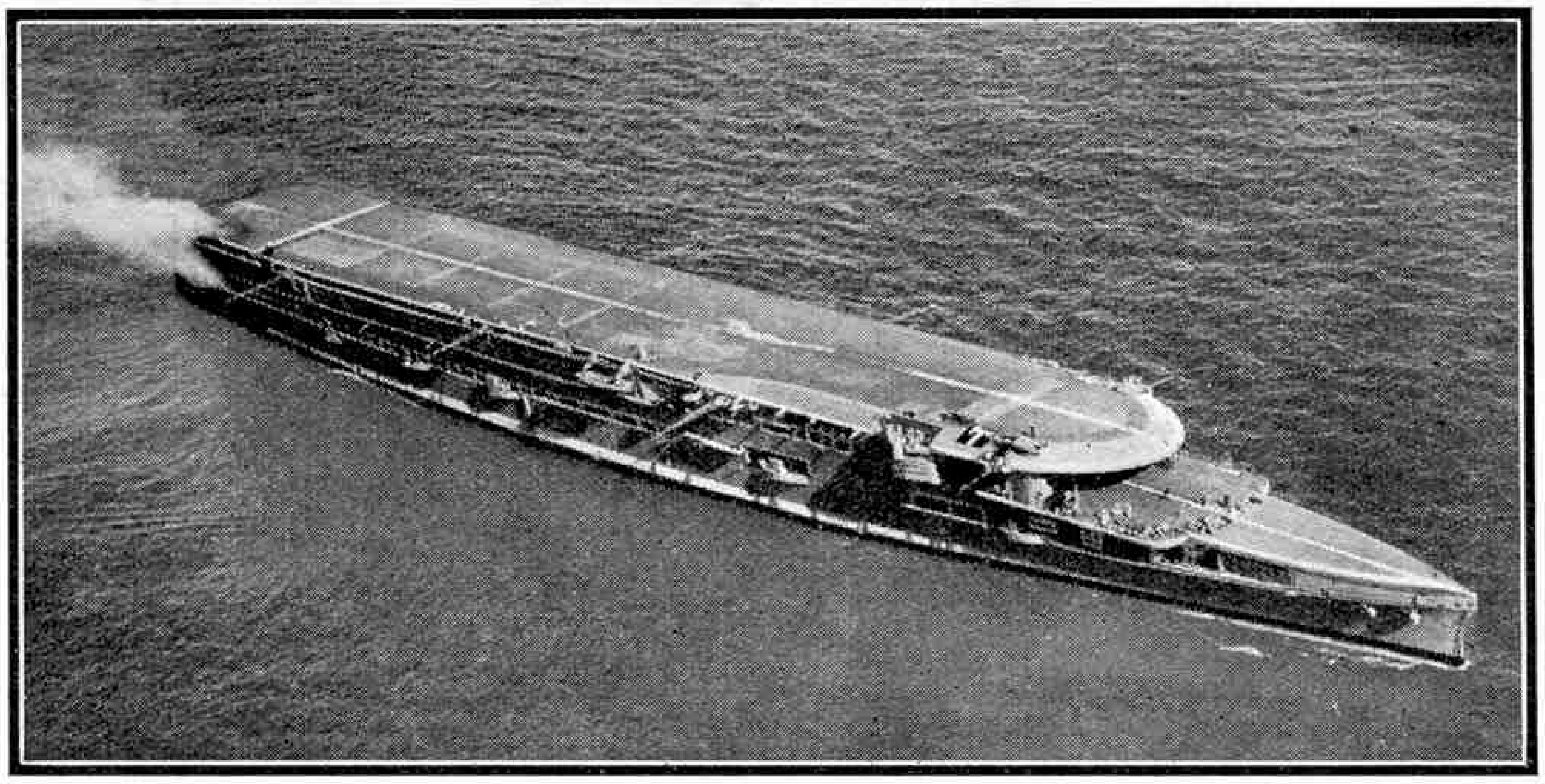
The South African Railways and Harbours Board have ordered three 10-seater high-speed air liners from the Junkers Company, of Germany. The aeroplanes will have a cruising speed of 215 m.p.h. at 6,100 ft. and when fully loaded will have a range of 655 miles. They will be used by South African Airways, a branch of S.A.R.H., on internal air routes.

The Eyes of the Navy

How a Modern Aircraft Carrier Operates

By B. S. Davies

AIRCRAFT used by the Navy can be classed under three main headings, namely, reconnaissance machines, fighters and torpedo-bombers. Whatever duty the machines themselves are designed to carry out, however, the operations in the carrier for flying off and alighting, or "landing on" are the same. The important point to remember is that with very few exceptions, all the aircraft used in carriers are land machines, that is to say, they are fitted with wheels, not floats. The flying deck of a carrier therefore is nothing more than a miniature aerodrome.

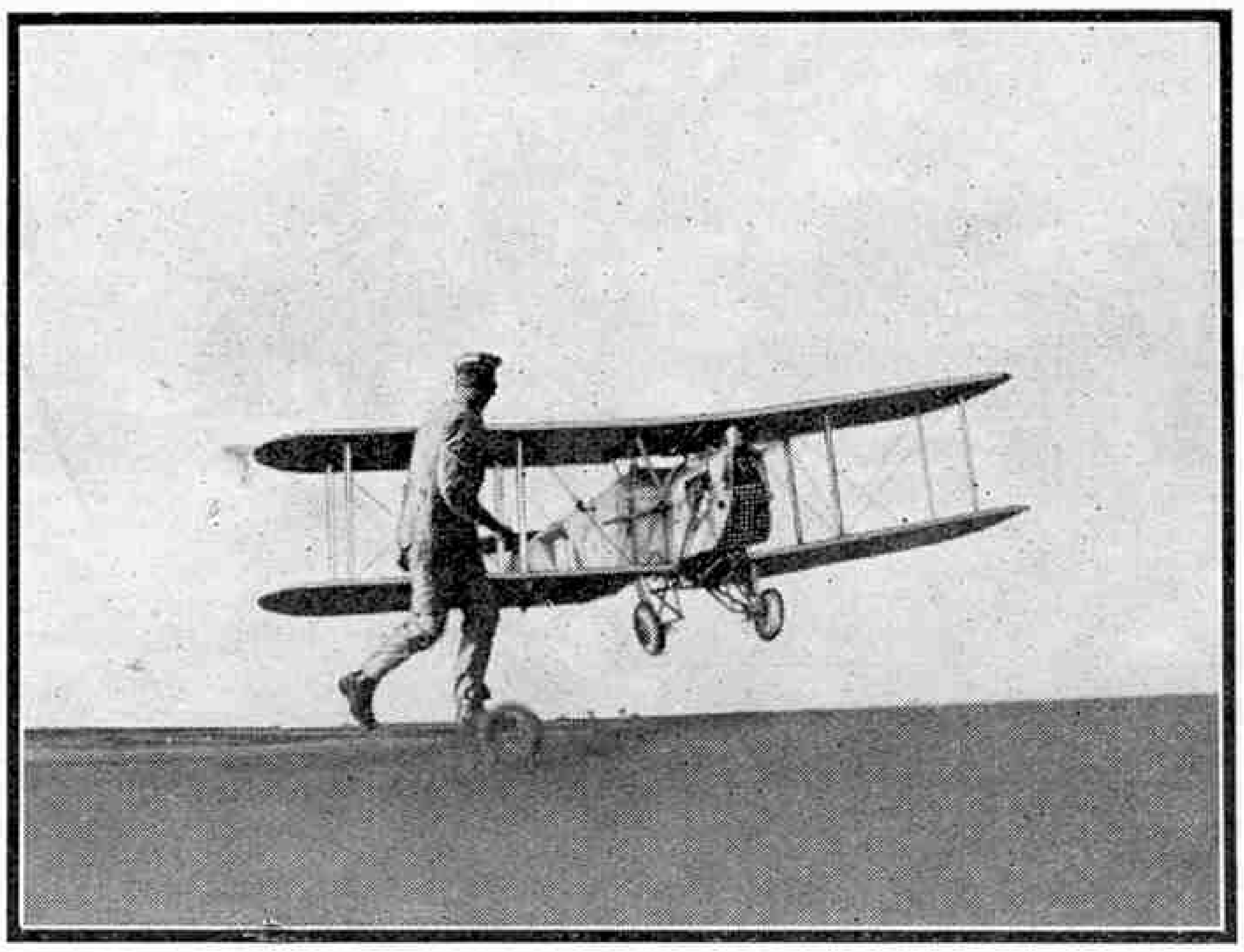


An airman's view of the aircraft carrier. The vessel shown is H.M.S. "Furious," which has specially fitted internal funnels to take smoke clear of the landing deck.

Compared with aerodromes ashore, the space in which machines have to land is very small indeed, and for this reason all the aircraft are designed to have a slow landing speed. Conversely, when flying off, they must be able to take off quickly and easily. Furthermore, all Fleet Air Arm pilots undergo special "deck-landing" training, for it must be remembered that they have to land on the deck of a ship that is moving through the water.

What then, is required of the carrier?

To start with, she must be able to steam at high speeds and maintain them for a considerable period; next, she must be capable of accommodating a large number of machines and have workshops for dealing with any type of repair; finally, she must have sufficient stowage for large quantities of petrol. Above all, we must not forget that she is a warship, and therefore must be armed with guns of suitable calibre.



A machine taking off from the deck of an aircraft carrier.

All the large aircraft carriers in use in the Navy, with one exception, are built with the bridge, funnels, mast and other parts of the superstructure on the starboard side, well clear of the flying deck. Immediately below the flying deck is an enormous hangar, and below that again is another hangar.

Machines are stowed with their wings folded back along the fuselage, and are transported from the hangars to the flying deck by means of huge lifts, situated at the ends of the hangars. These lifts are nothing more than large flat platforms made of steel, and are capable of accommodating one machine at a time with wings spread. Square holes of the exact size and shape of the lifts are cut in the upper hangar deck and flying deck, so that when flying is in progress, the lifts are left up and become one with the flying deck itself. At the fore end of the flying deck is a huge perforated steel wind screen. This is actually hinged to the deck, and is raised and lowered by machinery. It is used to protect machines on the flying deck when a high wind is blowing, or when the ship is steaming at high speeds. Round the edge of the flying deck, large steel meshed nets project to a distance of about 8 ft. as a precaution against machines over-running the deck and plunging overboard.

The upper illustration on this page shows H.M.S. *"Furious"* from the air. This vessel was designed to present an entirely unobstructed deck to the pilot. Special arrangements therefore had to be made to carry off the smoke and exhaust gases from the boilers, since the ship is driven by steam turbines and oil-fired boilers. These consisted of fitting internal fore and aft funnels, situated on each side below the flying deck, and the exhaust fumes from the boilers escape through the two large openings in the after end of the flying deck.

This is quite a satisfactory method for normal cruising, but when flying operations take place, it is essential not only that pilots shall have a clear view of the deck as they approach, but that the stability of the machines shall in no way be upset when flying at comparatively low speeds by passing through a mixture of smoke, hot gases and air prior to landing on. In order to overcome this, the passage of the exhaust gases is deflected, and instead of escaping through the openings in the flying deck, they are forced down and out of two other openings just below, in the ship's side. One of these can be seen in the photograph; the other of course is on the opposite side of the ship.

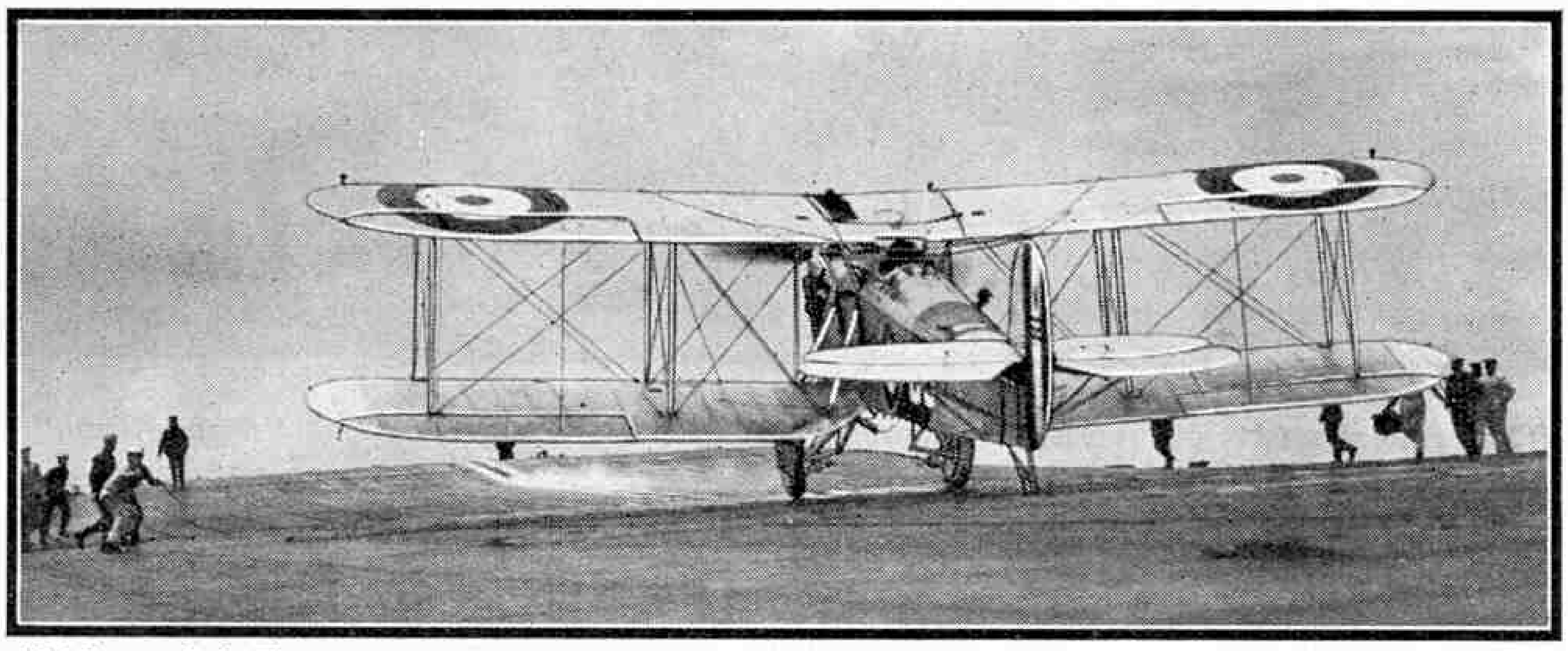
The bridge is situated at the fore end and on the starboard side of the flying deck, so that a machine has an entirely open but limited space on which to land.

This does not mean that the carrier with orthodox funnels and masts presents an obstructed deck. The contrary is the case, and many pilots prefer to land on this type of carrier rather than on the other, as the high superstructure helps them to judge height and distance as they overtake the carrier and descend to the flying deck.

Before a machine flies off or lands on, the carrier is turned into the wind, and it is the duty of the officer on watch to give the necessary orders to the helmsman to keep her dead into the wind. A very simple device is fitted to assist him. Right forward in the bows of the ship, a white line is painted on the deck in the exact fore and aft line of the ship. In front of it is a small steam jet, and as long as the feather of steam issuing from it blows along the white line, the ship is dead in the wind.

Having turned her into the wind, the next important point is to have the ship moving at the correct speed, whether a machine is going to fly off or land on. So let us see what happens from the time a machine leaves the hangar, flies off, lands on, and finally returns to the hangar again.

As soon as the pilot gets his orders, he climbs into his machine and starts up his engine for warming through. The lift is lowered and the machine wheeled on to it; the lift then ascends to the flying deck, during which time the machine's wings are spread. Meanwhile, up on the flying deck, the wind screen has been raised in order to protect the machine as she appears. When the lift reaches the level of the flying deck, it is locked in place, and the machine is pushed into a convenient position for flying off. This position depends on the strength of the wind, for if the wind is light the machine may require a long run; on the other hand, if the wind is strong, a short run will suffice. Let us assume that there is a steady breeze of 30 m.p.h., and that this particular aircraft has a flying speed of 70 m.p.h.



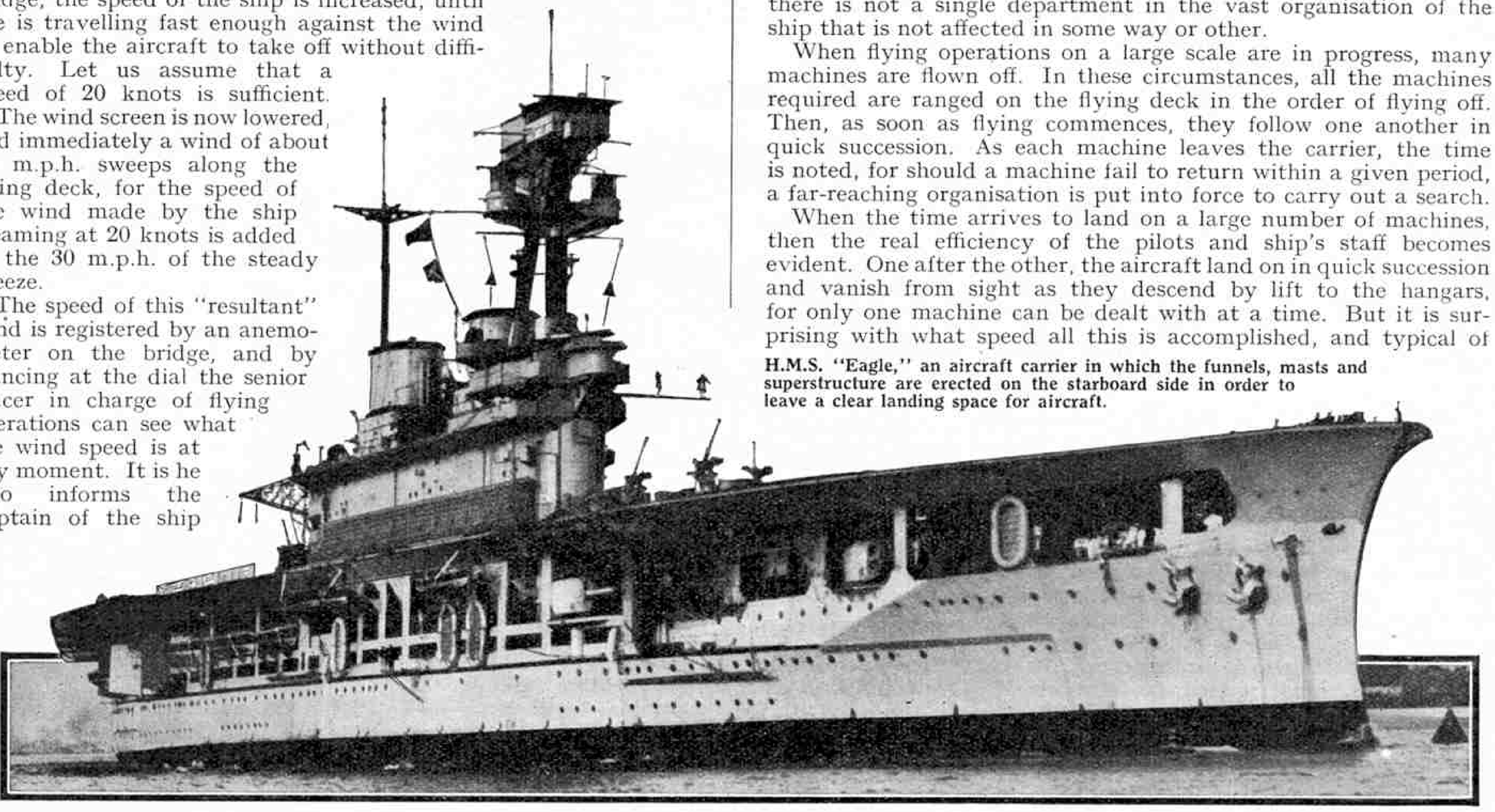
Alighting on deck. The members of the flight deck party are rushing out to seize the machine as she comes to a standstill.

The pilot now runs his engine up to see that everything is in order, while a party of men, known as the flight deck party, hold the machine. If satisfied, he closes his throttle and awaits the signal to fly off from the officer in charge of the flying deck.

Meanwhile, in response to orders from the bridge, the speed of the ship is increased, until she is travelling fast enough against the wind to enable the aircraft to take off without difficulty. Let us assume that a speed of 20 knots is sufficient.

The wind screen is now lowered, and immediately a wind of about 50 m.p.h. sweeps along the flying deck, for the speed of the wind made by the ship steaming at 20 knots is added to the 30 m.p.h. of the steady breeze.

The speed of this "resultant" wind is registered by an anemometer on the bridge, and by glancing at the dial the senior officer in charge of flying operations can see what the wind speed is at any moment. It is he who informs the Captain of the ship when the ship is moving at the correct speed. As soon as this is attained the Captain indicates to the officer in charge of the flying deck that the machine may fly off. This officer then signals to the pilot, and the men who have been standing by the machine move away as the pilot opens his throttle and the machine rushes along the deck. After a comparatively short run the machine reaches her flying speed and rises, and when she is safely in the air the speed of the carrier is reduced and her former course resumed.



H.M.S. "Eagle," an aircraft carrier in which the funnels, masts and superstructure are erected on the starboard side in order to leave a clear landing space for aircraft.

The same procedure is gone through when the aircraft lands on again. The carrier is first turned into the wind, and speed is increased until a wind with the necessary speed sweeps along the flying deck. Then a signal is displayed to indicate to the pilot that he may land on. Immediately he circles round and approaches from well astern, getting lower and lower until the machine skims over the after end of the flying deck, losing height and speed. As soon as the wheels touch the deck, she quickly loses speed and comes to a standstill, whereupon the wind screen is raised and the flight deck party rush out and seize her. Without delay, she is wheeled on to the lift, which disappears from sight as it descends to the hangar.

So much for the actual operation of flying off and landing on. When flying takes place, however, the air personnel are not the only members of the ship's company who are affected. In the engine and boiler rooms, everybody is on the alert, especially if the wind is fitful, for in such conditions the ship might be called upon for sudden high increases of speed. Calls of this description require prompt action in the boiler rooms; additional oil-sprayers must instantly be turned on so that more steam can be generated for the turbines. On the other hand, a machine might have an accident that necessitates the carrier stopping at once. Such orders demand high skill and prompt action, for the men below are dealing with engines and boilers developing something like 90,000 h.p.

Elsewhere in the ship, organised activity is manifest; men are standing by boats in case of accidents to machines; cranes, with which every carrier is equipped, are got ready for instant use; the medical staff with first aid equipment stand by. In fact, there is not a single department in the vast organisation of the ship that is not affected in some way or other.

When flying operations on a large scale are in progress, many machines are flown off. In these circumstances, all the machines required are ranged on the flying deck in the order of flying off. Then, as soon as flying commences, they follow one another in quick succession. As each machine leaves the carrier, the time is noted, for should a machine fail to return within a given period, a far-reaching organisation is put into force to carry out a search.

When the time arrives to land on a large number of machines, then the real efficiency of the pilots and ship's staff becomes evident. One after the other, the aircraft land on in quick succession and vanish from sight as they descend by lift to the hangars, for only one machine can be dealt with at a time. But it is surprising with what speed all this is accomplished, and typical of the skill of this highly efficient branch of the Navy.

The number of men on board an aircraft carrier varies, but the normal crew of the "*Eagle*" is 750 naval officers and men, in addition to 250 officers and men of the Fleet Air Arm. Great care has to be taken of the aeroplanes used, and each machine has at least two men whose sole duty is to look after it. For instance, a single seater aeroplane is in charge of two R.A.F. airmen, a fitter and a rigger; and a machine fitted with wireless also has a Telegraphist Air Gunner, who is a naval rating and accompanies the pilot and the observer on their flights, in addition to being responsible for keeping the wireless apparatus in repair. A handling crew always deals with the same squadron and usually consists of about 10 naval ratings.

Speedy Work with *"The Irish Mail"*

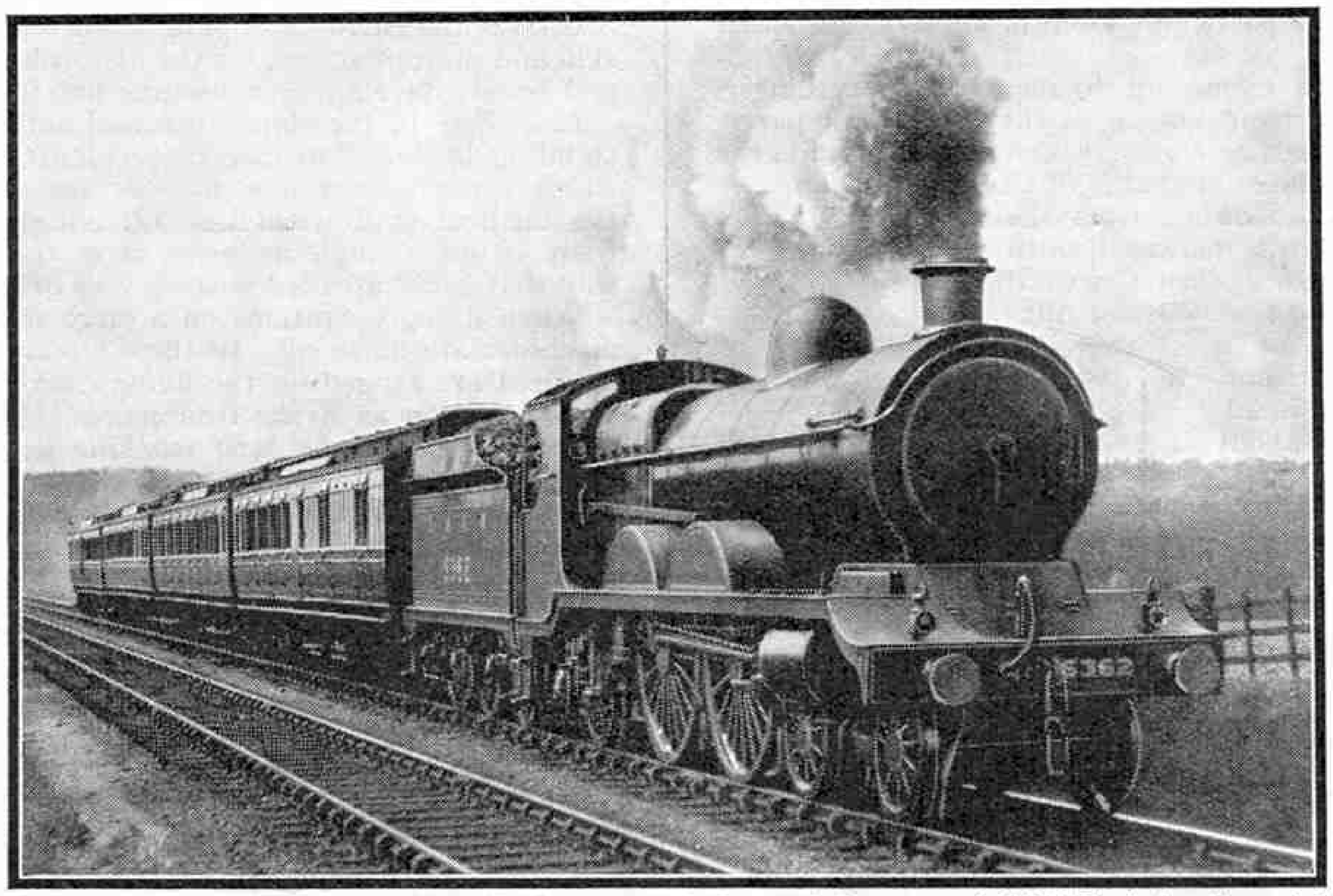
Now that the principal Scottish expresses are hauled by "Princess Royal" class 4–6–2s, the hardest daily task undertaken by the "Royal Scots" is the working of *"The Irish Mail"* between Euston and Holyhead. On a recent journey with this train, No. 6120, *"Royal Inniskilling Fusilier,"* ably handled by Driver H. Jones of Holyhead, made some splendid running with a gross load of 460 tons. The 65.1 miles from Watford to Rugby were covered at an average speed of exactly 60 m.p.h. start to stop, the 48.6 miles from Tring to Hillmorton being run at 67 m.p.h., with a maximum of 78 m.p.h. Continuing from Rugby, Stafford, 51 miles, was passed in the remarkable time of 50½ min. and Crewe, 75.5 miles, was reached 5 min. early in 78 min. from Rugby. With a reduced load of 390 tons the 21.1 miles to Chester were run in 24½ min. a top speed of 69 m.p.h. being reached at Beeston Castle.

For the last stage of the journey the load was made up to as much as 514 tons tare and 540 tons full. By dint of magnificent locomotive work, the 84.6 miles from Chester to Holyhead were covered in 94¾ min.—1¼ min. under schedule—despite three permanent way slowings. The fastest running was made across Anglesey where speed rose to 73 m.p.h. at Bodorgan; in all, 15½ min. were gained on schedule on this remarkable trip.

Another very fast run was that made recently by one of Mr. Stanier's remarkably versatile 4–6–0 engines of class "5P5F" on the 4.40 p.m. up Sunday Scottish express from Crewe to Euston. No. 5028 was the engine, hauling a gross load of 380 tons. After a fine climb to Whitmore, speed rose to no less than 79½ m.p.h. on the descent to Stafford on a gradient as slight as 1 in 650, but on account of signal checks the 24½ miles from Crewe to Stafford took 35½ min.

After passing Rugeley there came some magnificent running, with an average of 66 m.p.h. from Lichfield to Rugby and maximum speeds of 75 m.p.h. at both Hademore troughs and Brinklow. Thus Rugby was passed in a net time of 74½ min. from Crewe, 75½ miles, that is in only 1½ min. more than the schedule of the up *"Liverpool Flyer,"* and with a mixed traffic engine!

After further good work south of Rugby, Euston was reached in a net time of 159½ min. for the 158.1 miles from Crewe, a gain of 10½ min. on schedule. On this last stage the highest speeds were 75 at Weedon, 76½ at Kings Langley, and 74 at North Wembley. Alcock, of Crewe shed, was the driver. These runs were recorded by Mr. O. S. Nock.


An interesting example of joint operation. An Oxford to York through train composed of G.W.R. stock and operated by an L.N.E.R. (G.C. section) 4-4-2 locomotive is shown in our photograph, which was taken at East Leake, and is reproduced by courtesy of the L.N.E.R.

G.W.R. Streamlined Parcels Rail Car

A new streamlined rail car specially built for parcels service has been brought into use by the G.W.R. This operates between London and local stations to Reading and Oxford. The car is similar in design to the streamlined passenger rail cars already in service, but instead of the windows of these cars it has three glass-panelled doors on each side to facilitate rapid loading and unloading. A series of racks is provided inside for the accommodation of parcels. The car is driven by two heavy-oil engines of 130 h.p. each, and is capable of speeds of 70 to 75 m.p.h. With the introduction of this rapid means of parcels conveyance it is hoped to avoid the delays that are sometimes suffered by ordinary passenger trains at stations where parcels traffic is dealt with.

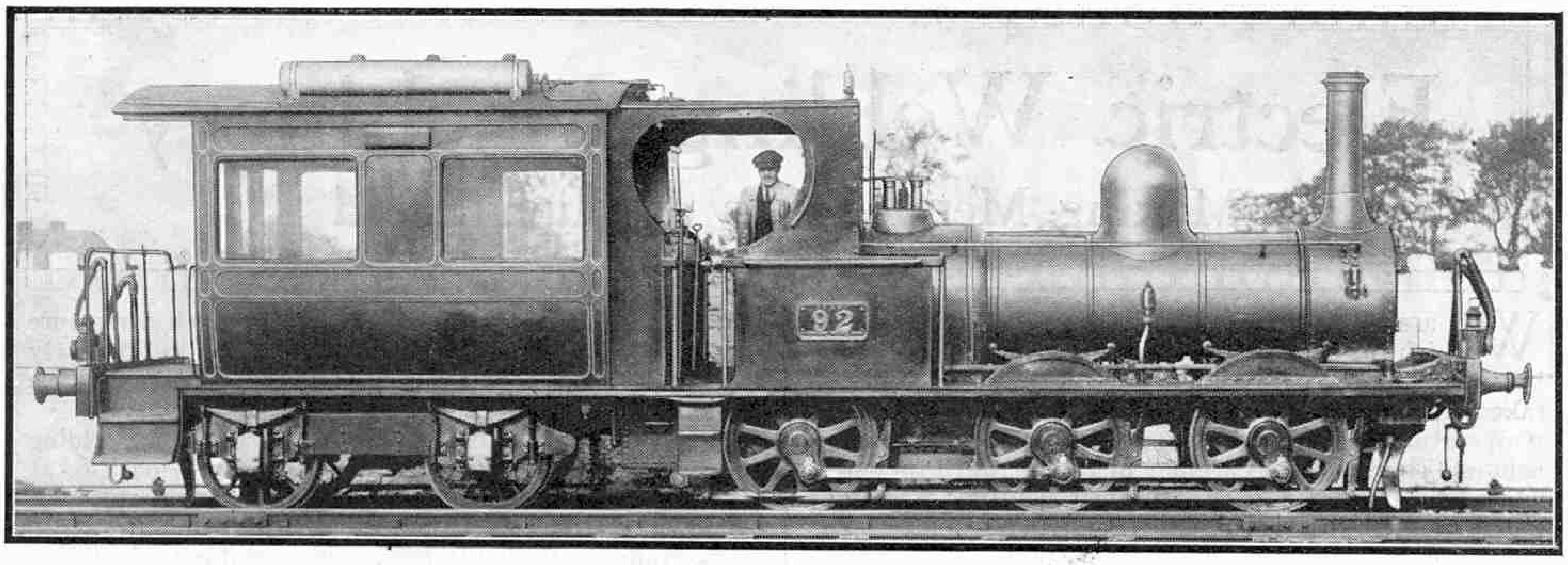
"Right-Away," by Rail and Sea

Mr. Hugh Morgan, who has recently retired from the position of L.M.S.R. Station Master and Goods Agent at Holyhead after over 40 years' service, is one of the few railway officials who has ordered the departure of steamers as well as trains. For more than 23 years, Mr. Morgan has seen the "right-away" given to the Irish Mail trains and also to the Royal Mail steamers sailing from Holyhead. During the War, he was Night Station Master at Holyhead, and in this period nearly 3,000,000 troops passed through the port on their way to and from Ireland. At times of crisis, Mr. Morgan's name on the labels of reserved compartments or in the reserving of steamer accommodation afforded a valuable "alias" to prominent political or military personages whose travels were intended to be kept secret. In recognition of his services at Holyhead during the War he was awarded the diploma of the Lords Commissioners of the Admiralty.

A native of Liverpool, Mr. Morgan hails from a seafaring family and as a boy was employed with two Liverpool shipping firms. In 1895, however, he entered the railway service as a porter at Alexandra Docks, Liverpool, and rose through successive grades to the position from which he has now retired.

Clothing the L.M.S.R. Staff

To clothe its employees, the L.M.S.R. use 750 miles of British-manufactured cloth which, if stretched in a single line, would extend further than from London to Wick. The requirements are of a varied character, and include garments for station and yard staff, enginemen, permanent way men, guards, signalmen, messengers, carters, police, hotel and restaurant car staff and the crews of steamers. The height of the tallest man in the service of the Company is 6 ft. 8 in., and that of the smallest 4 ft. 3 in. Engine drivers possess the finest physique, with an average chest measurement of 50 in., but honours for height are carried off by the passenger guards.

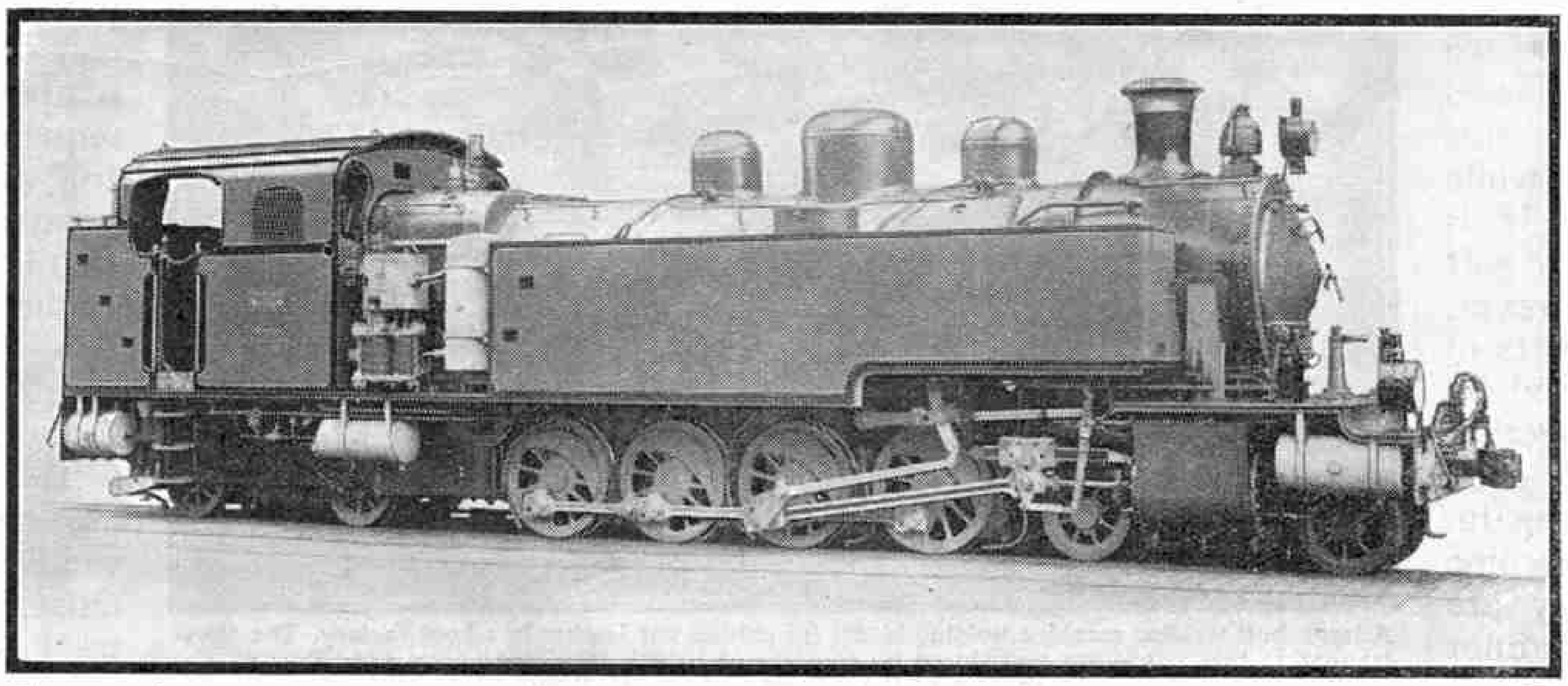


G.W.R. Record Summer Service

The G.W.R. have introduced numerous additional expresses for earlier holiday-makers in May and June and the daily daylight service to the Channel Islands will operate from 8th June with a connecting boat train that will leave Paddington at 8.30 a.m. The full Summer Service will operate from 6th July to 27th September.

The number of trains to be run daily will be 6,540, covering a daily mileage of 126,790. Both these figures are G.W.R. records.

Streamlined rail cars will be operating over a further 2,104 miles daily as compared with last summer, and there will be expresses covering 1,667 miles daily at 60 m.p.h. or over. The services between London, Birmingham, and North Wales and Cambrian Coast resorts will be generally improved. Through trains between Birmingham, Hereford and Cardiff will be speeded up. On Saturdays, when the bulk of holiday traffic passes, the main and cross-country expresses will be greatly increased. In some cases, the ordinary weekday services will be nearly doubled. Expresses will be rearranged and run via alternative routes in order to maintain a steady flow of traffic to the West Country and South Coast resorts.



The upper illustration, reproduced by courtesy of the Great Southern Railways of Ireland, shows the curious 0-6-4 "steam cab," or combined locomotive and coach referred to on this page. In the lower photograph is a powerful 4-8-4 narrow gauge tank locomotive built for service in Morocco. Photograph reproduced by courtesy of Henschel and Sohn A.G., of Cassel.

The *"Cornish Riviera Limited,"* on Saturdays, will become a group of three trains leaving Paddington respectively at 10.25 a.m. for Plymouth, Truro and Falmouth; at 10.30 a.m. for Helston, St. Ives and Penzance; and at 10.35 a.m. for Plymouth and the principal Cornish stations. The up *"Riviera"* will be two trains, one leaving Penzance at 10.0 a.m. and carrying passengers from St. Ives and Falmouth; and the other leaving St. Erth at 10.20 a.m. and carrying passengers from Helston, Par and Plymouth. Sunday editions of the *"Cornish Riviera Limited"* and the *"Torbay Express"* will also be run at the same times from Paddington as on weekdays, and the evening services are to be improved.

An Irish "Steam Cab"

A veteran combined locomotive and coach of considerable interest that is still in service on the Great Southern Railways of Ireland is shown in the upper photograph on this page. It is described as a "steam cab," and the locomotive portion is numbered 92.

The unit was one of several of this kind introduced in 1880 for branch line service. The possibility of mixed train working and the consequent necessity for performing shunting operations at wayside stations no doubt accounted for the adoption of six-coupled wheels. The work became too heavy for these combined units and they were withdrawn, with the exception of No. 92. This has been used for many years for the conveyance of officials between the works at Inchicore and Kingsbridge Station, Dublin, where the offices of the Company are situated.

"The Merseyside Express" Accelerated

Since 4th May *"The Merseyside Express"* from Liverpool to Euston has been accelerated by 10 minutes, the journey now taking 3 hrs. 20 min. The 189.7 miles from Mossley Hill, near Liverpool, where a stop is invariably made, are timed to be covered in 189 min. This involves an average speed of 60.2 m.p.h.

On the first day of the accelerated schedule 4–6–2 locomotive No. 6210 *"Princess Patricia,"* with a fourteen-coach train, reached Euston four minutes early. The enginemen were Driver T. Lyon and Fireman W. H. Harris.

G.N.R. (Ireland) Dining Car Experiments

Experiments are in progress on the G.N.R. of Ireland with two types of cooking equipment on the Dublin-Belfast restaurant services. One car is fitted for gas cooking and another with a special anthracite-fired cooker. On the gas-equipped car four steel cylinders are carried, lying across the car below the underframe. These are removable and are charged daily to a pressure of 3,000 lb. per sq. in. at the Belfast gasworks. Non-corrosive steel piping arranged outside the car conveys the gas to a two-stage governor that reduces the pressure of the gas before it passes to the cooking apparatus.

The anthracite cooker in the other car is stated to be the first of its kind used on a railway in the British Isles. Only one firing of the cooker is required for a return trip between Belfast and Dublin.

Specials for Pigeon Traffic

During the pigeon racing season numerous special trains are operated by the L.M.S.R. to convey homing pigeons to the point where they are released for their flights. It is estimated that by September some two million pigeons will have been carried by the L.M.S.R. during this season, necessitating the use of 1,804 vans, in addition to luggage brake vans.

In order to assist the railway staff in the working of this traffic a special 72-page booklet is issued.

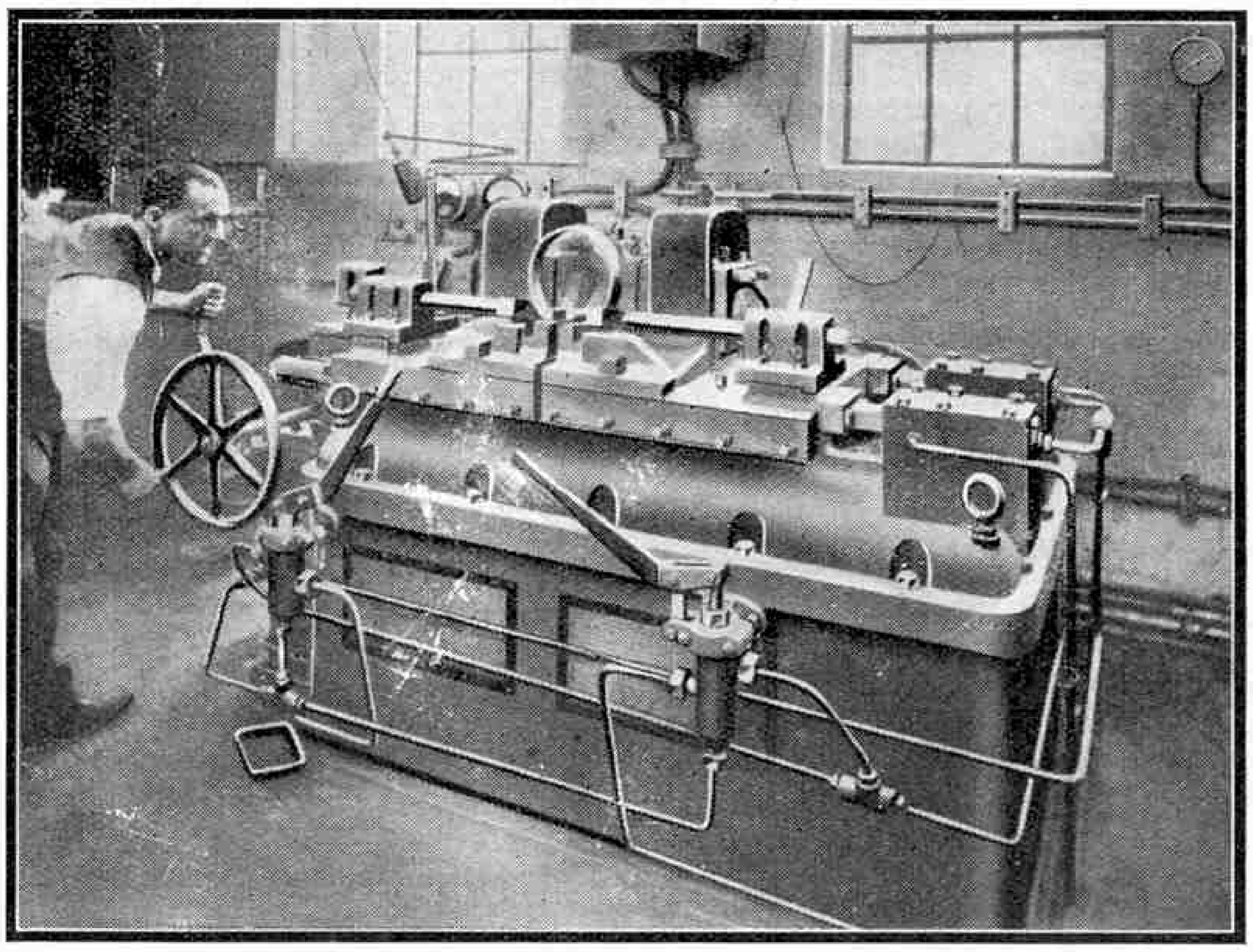
Better Protection for Fragile Goods

An interesting experiment has recently been completed by the G.W.R. with the object of reducing damage in transit to eggs, soft fruit, and other fragile goods that are liable to injury, however carefully they are handled. The interior of a van is fitted with a series of partitions that can be adjusted to hold the stacked goods firmly in position, no matter how small the load in the vehicle may be. The experiment has lasted a year, and it has proved so successful that a further 100 vehicles are being adapted.

Electric Welding Machinery

Making Metal Joints at High Speed

WE are all familiar with the blacksmith's forge in which the ends of a broken hoop can be heated and hammered together or welded. For this process the fire is raked out clean and free from clinkers and dross, and its temperature raised by blowing air through it by means of bellows. The hoop ends are left in the fire until they are white hot, and the ends are then gently hammered together until they are united. Finally the welded iron is allowed to cool down to its solid state.



A large butt welding machine welding blades for cutting out leather in a boot factory. The illustrations to this article are reproduced by courtesy of British Insulated Cables Ltd., Prescot, the makers of the machines shown in them.

In order to understand what happens when a weld of this kind takes place it is necessary to know the changes that occur in a metal when it is heated. Ordinary butter will serve as an illustration of these changes. When this is very cold it is solid and too hard to spread. On heating it becomes a liquid, but there is an intermediate state in which it is plastic and then it can easily be worked. If we wish to mix two masses of butter together, this cannot be done while they are frozen. It is easy when they are soft and plastic, however, and the constituents of the mixture formed by pressing them together will not separate, even when it is frozen again.

Many metals become plastic when they are heated. They cannot then be worked as easily as butter, but can readily be welded by hammering or applying pressure to squeeze together the pieces that are to be joined. The necessary force must be applied while the metal is still hot enough to be plastic. For example, pure iron remains solid up to a temperature of 1,130 deg. C., when it becomes plastic, and its melting point is about 1,500 deg. C. Iron and steel, and their alloys, therefore can be welded at some temperature between 1,130 deg. C. and 1,500 deg. C. The exact temperature that is most suitable depends upon the composition of the metal or alloy, for the presence of impurities alters the range of temperature through which it remains in a plastic condition.

At the blacksmith's shop heat is lost when the pieces of metal are taken out of the fire and more material than is really necessary must be heated in order to provide a reserve to check the rate of cooling. The ends to be welded therefore are usually made white hot for a length of say two or more inches. On the other hand, great care also must be taken not to overheat the metal, or burn it. When this happens with say iron or steel, the metal is oxidised and forms flakes of scaly material. This is not plastic, and its condition somewhat resembles that of butter that has been mixed with flour. Such a mixture cannot be pressed readily into a single mass, and similarly the scale formed when iron is overheated cannot be welded.

Ingenious machines are now available for welding operations of many kinds. In these the heat is localised at the position of the weld, so that the parts made white hot are comparatively small in extent. The temperature also is carefully controlled to reduce damage due to oxidation and the resulting weld therefore is stronger than that made by the cruder operations of the blacksmith.

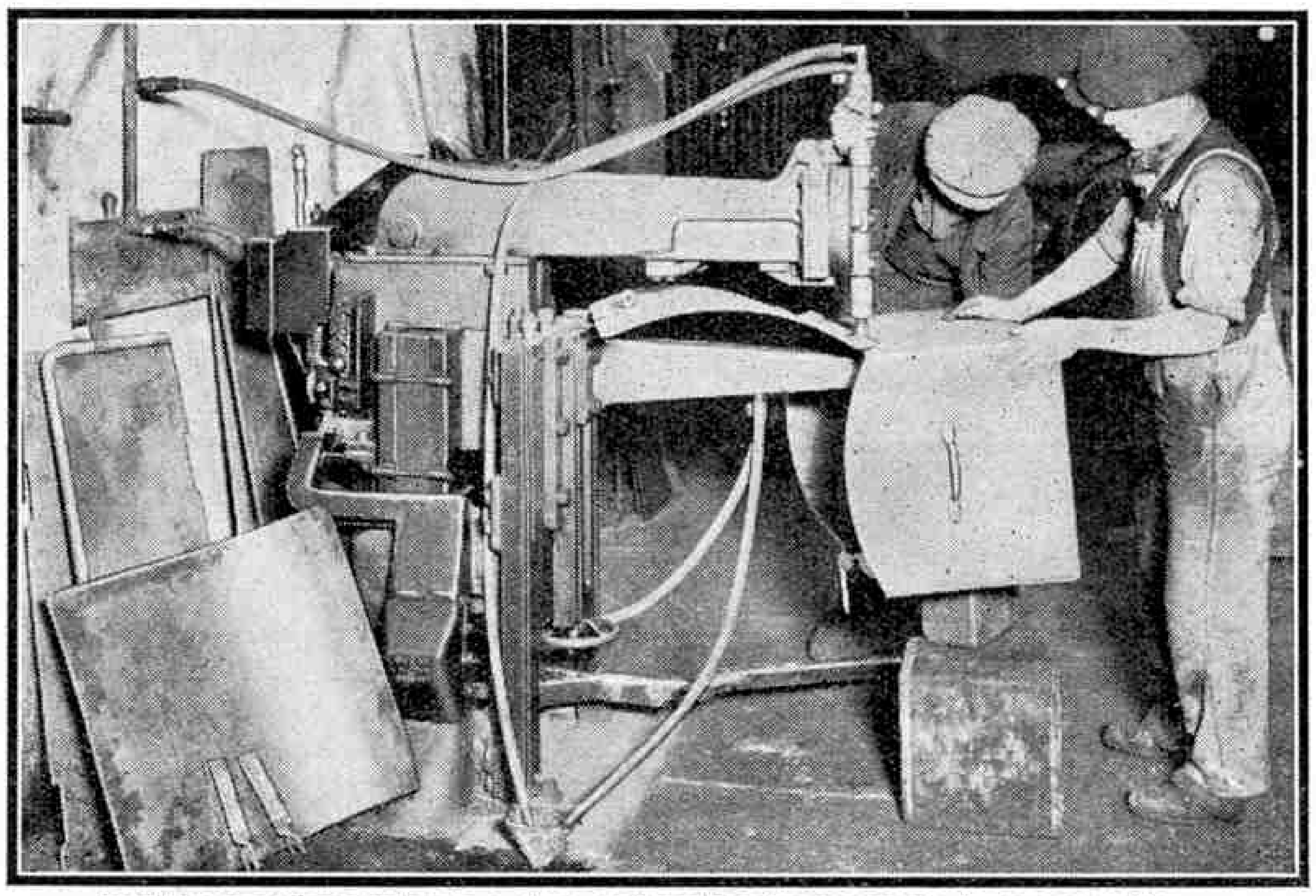
The modern welding machine is electrical in operation. In it the parts to be welded are placed together and a very heavy current is passed through them and across the join. The electrical resistance at the point of contact is high compared with that of the rest of the circuit. The temperature there consequently rises rapidly, and when welding temperature is reached mechanical pressure is applied to squeeze the two pieces of metal together to form a sound weld.

This process is known as electric resistance welding. Alternating current similar to that used for ordinary electric lighting is employed, but the best results are obtained by employing a low voltage. A transformer therefore is used to change the mains supply voltage to that required by the welding machine.

In some cases the ends of two pieces of metal to be united are simply brought into direct contact, or butted together, to form what is known as a "butt weld." One form of machine in which this is done usually consists of a table supporting two sliding grips or rests that hold the electrodes, through which current is led in, and the work to be welded. The transformer is housed under the table and the necessary instruments to guide the operation are mounted in some convenient position. When the work is set up in the machine, turning a hand wheel slides the rests towards one another and the ends to be welded are brought into contact. The current is switched on and when the correct temperature has been reached the rests are brought slightly nearer together to squeeze the weld.

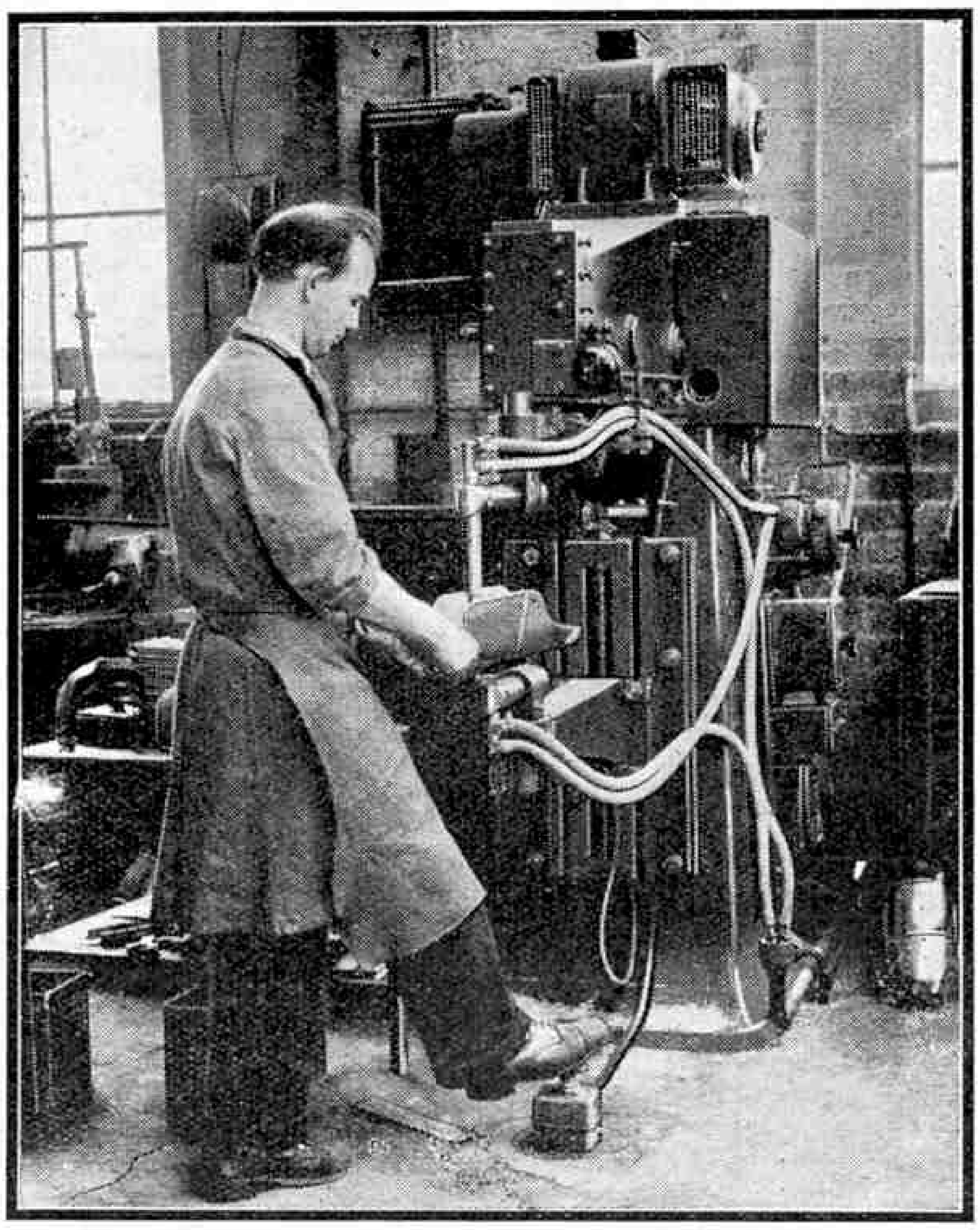
The power required for completing the weld usually is much greater than can be applied by hand. For instance, a total pressure of 50 tons may be necessary when welding together sections of pipes up to 18 in. in diameter and with a cross sectional area of 30 sq. in. Hydraulic power therefore is used to give the final squeeze.

The surface of a joint made by butt welding is slightly swollen owing to the heavy pressure that has been applied to the metal while it is still plastic. The increase in size is very slight, and in the case of a steel bar 1 in. in diameter is not much more in thickness than a wedding ring. The unwanted metal can easily be ground away from the outside, and its removal does not affect the strength of the weld.


Welding the hinged lid on to a sheet steel tool box by means of a large spot welder

Butt welding machines have been made to deal with wires less than 1/16 in. in diameter, but much larger machines also are in regular use. Some of these weld together metallic surfaces up to 40 sq. in. in area, and one machine employed in the production of sheet metal bodies for motor cars makes welds of this type 90 in. in width.

Sometimes pieces of metal can best be united with an overlap. If the joint need not be watertight, it may be sufficient to weld the parts to be joined in spots, each of which then takes the place of a bolt or screw. Spot welding, as this method is called, can be applied to materials of various thicknesses, from a few thousandths of an inch, as in the case of small wireless parts, up to half-an-inch. An interesting feature is that the welds made must occupy the same area as the bolt-holes they displace.


A "continuous spot" welder seam welding spare-wheel supports in motor car works

Two or more sheets to be joined together in a spot welding machine are placed between two copper tips, or electrodes, that are brought together by means of a hand lever or pedal, or in certain cases by power-driven mechanism. The necessary pressure is applied to the electrodes through a spring and current is automatically switched on when this is compressed to a certain extent. The spring is further compressed when the correct welding temperature is reached, and this completes the weld and automatically switches off the current.

The machine can be so arranged that it is impossible for the operator to overheat the metals to be joined, or to stop the action before they are hot enough. This automatic action depends on the fact that the resistance at the point of contact falls as the metals become united. An increase in the strength of the current across the weld follows, and when this reaches a pre-determined value the electric circuit is broken automatically. This ingenious form of control is particularly valuable when thick material is being welded, for the temperature and appearance of the outer surfaces of the metal then are useless as guides to the conditions at the point where the welding is being carried out.

Spot welders usually are brought into operation by pressing a pedal down. They can be designed to make one weld each time the pedal is depressed, but if required they work continuously while it is down. In the latter case they work at high speed and may make up to several hundred welds an hour.

It is interesting to note that spot welding machines manufactured by British Insulated Cables Ltd. are used in the Meccano Factory for many purposes, including the welding of transformer casings and joining rudder brackets to theHornby Speed Boats.

Sometimes it is insufficient to fasten two overlapping sheets of metal together by means of a few welded spots. In these cases the welding can be made in a continuous series of spots. Metal sheets to be united in this manner are passed between two rotating copper discs that act as electrodes, leading in the electric current. These act as rollers, pressing the sheets between them as they are welded in order to form a continuous joint. Such welds can be made in materials of thicknesses up to 3/16 in., and the disc electrodes employed are driven at a constant rate. It is necessary that the welding surfaces of the sheets should be clean. For this reason grinding, pickling, or sand-blasting is essential before seam welding, as this process is called, is carried out.

The main features of the welding process are its simplicity and economy. For instance, the longitudinal seams of five-gallon paint drums made of mild steel sheets .022 in. in thickness are welded at a cost of one-third of a penny per drum. The price includes grinding the edges before welding, labour and electrical energy for welding, and the cost of maintaining and replacing the electrodes.

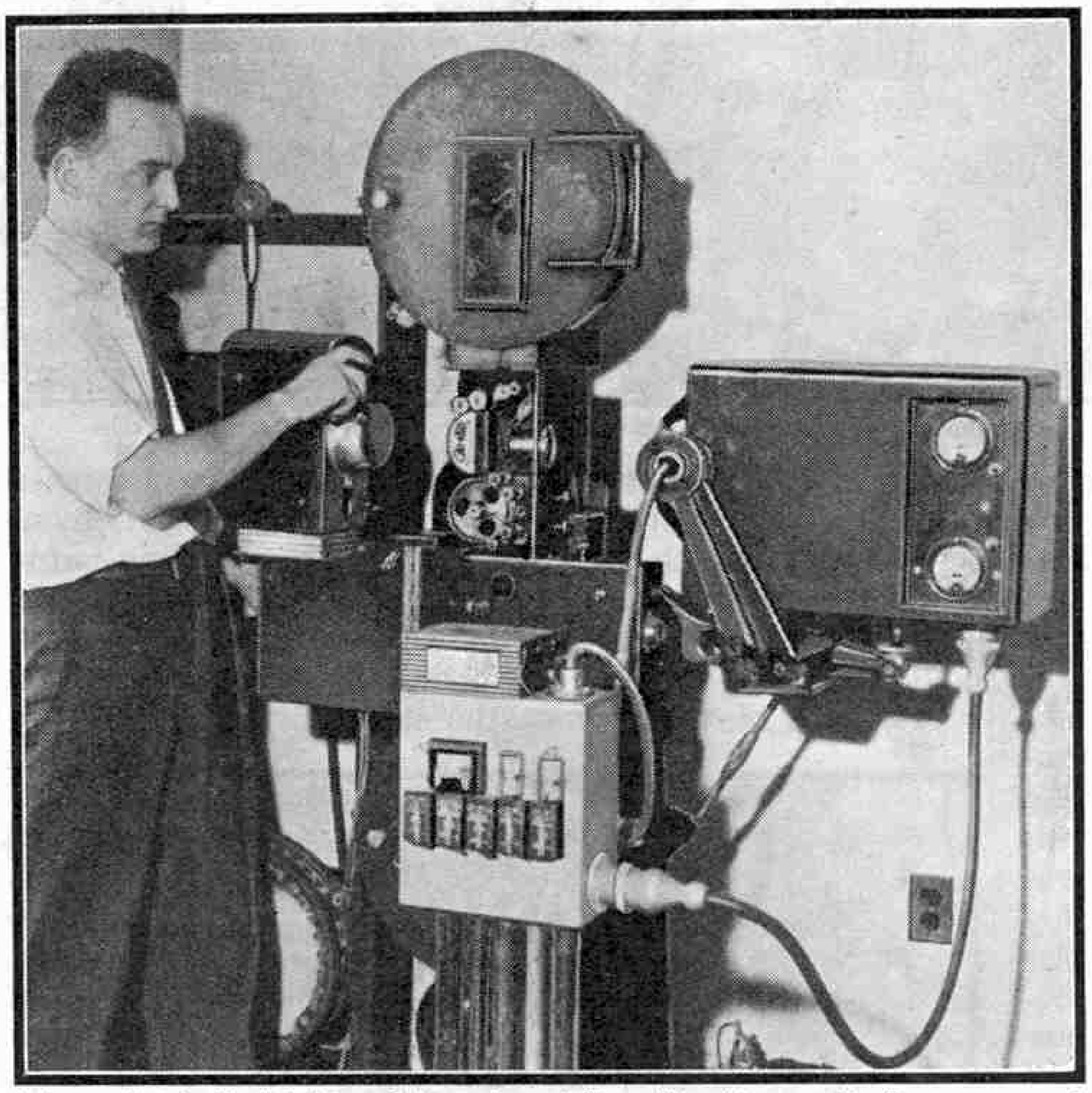
A particularly interesting example of the value of welding is provided by the manufacture of tools for work on heavy lathes. The steel used for the cutting edges of these tools is expensive, and it would be wasteful to make an entire tool of it, for the greater part of the metal then would not serve the special purpose for which it has been produced. For this reason the body of the tool is made of less costly metal and cutting edges of the more expensive tool steel are simply welded on their ends

High Definition Television

Pictures Formed by Invisible Electron Beam

By W. T. Lowe and E. Phillips

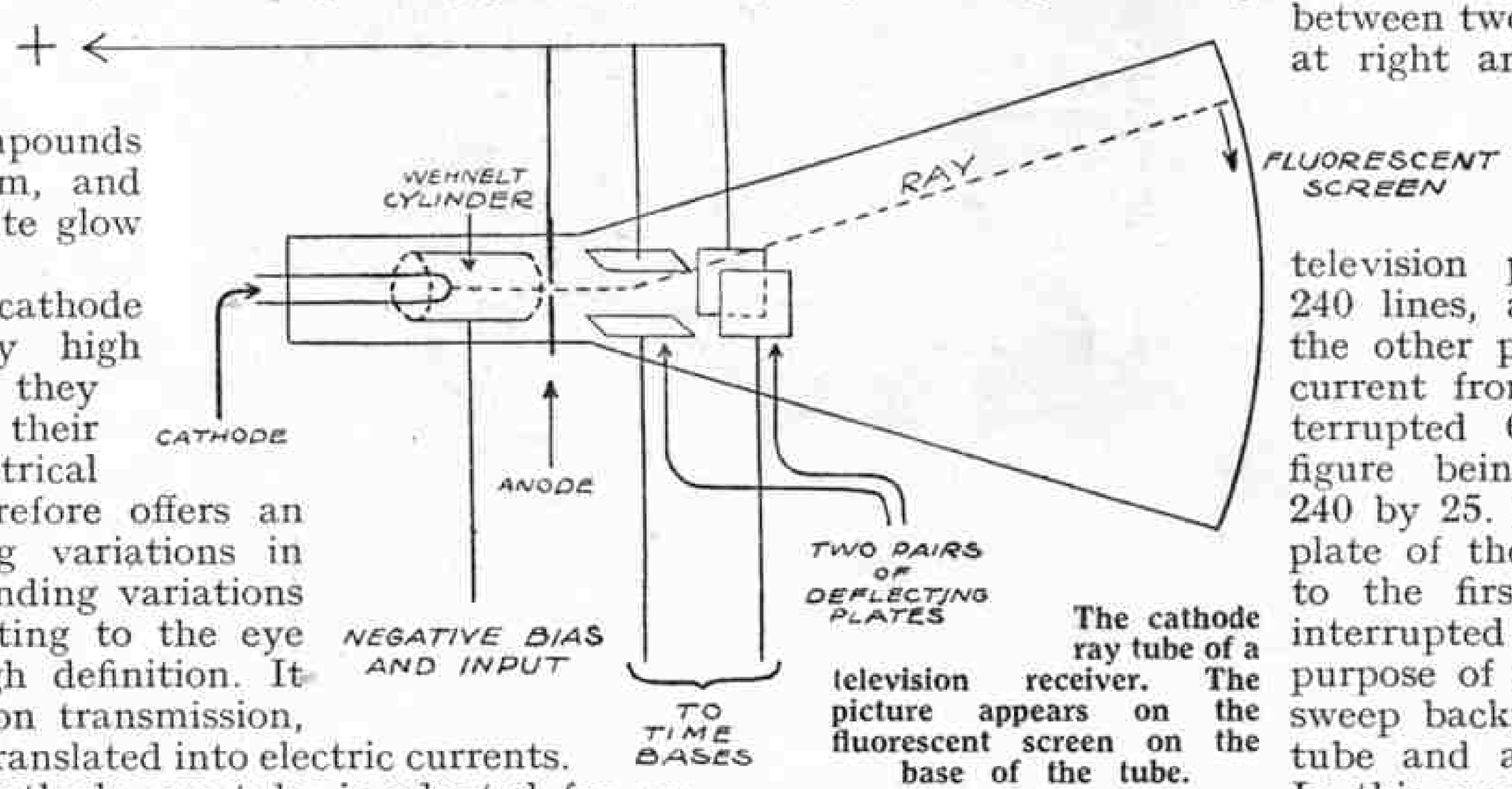
WE are on the threshold of interesting developments in television, for work is now proceeding on the installation of two television systems in the Alexandra Palace, North London, from which regular services will shortly be transmitted by the British Broadcasting Company. These systems are a great advance on the one used in previous television broadcasts of the B.B.C. That system was mechanical in character and gave a picture that was built up of only 30 lines. Reception with a greater number of lines, and therefore with better definition, can be obtained mechanically, but only electrical apparatus will be used for the high definition television, with 240 or 405 lines a picture, that is to be broadcast from the new station.



A transmitter for the television of cinematograph films. The pictures on the films are scanned by the Farnsworth Electron Camera referred to in the accompanying article.

The central feature of the new system is a special form of what is known as the cathode ray tube. This is a glass tube that has been exhausted to provide a vacuum, and contains two plates or wires, known as electrodes, that are connected by wires passing through the glass to the positive and negative terminals of a source of electricity. The electrode charged negatively is called the cathode and is the source of a stream of electrons, or particles of negative electricity, to which the name of cathode ray has been given. The production of electrons is stimulated by heating the cathode by current from a battery. The second electrode is known as the anode and as it is positively charged to 500 v. or more, it attracts the electrons, which pass at high speed across the space in the tube to strike its opposite end. If this end is covered with a fine layer of certain chemical compounds the impact produces a glowing green spot. A coating of this kind is known as a fluorescent screen. The materials usually employed in making it are compounds of zinc, calcium or cadmium, and special mixtures giving a white glow can now be used.

The electrons forming the cathode rays travel with incredibly high speed, and are so light that they are easily diverted from their paths by making use of electrical attractions. The stream therefore offers an excellent means of changing variations in electric current into corresponding variations of light, and thus of presenting to the eye moving pictures of very high definition. It also can be used for television transmission, for it enables light rays to be translated into electric currents.



The cathode ray tube of a television receiver. The picture appears on the fluorescent screen on the base of the tube.

Let us now see how the cathode ray tube is adapted for use in a television receiver. The shape given to a tube employed for this purpose is that of a conical flask, the cathode being placed in the neck and the fluorescent screen on the broad base. Immediately in front of the cathode is a metal plate with a small aperture at its centre. This plate is the anode and is charged positively to attract the negative electrons at high speed.

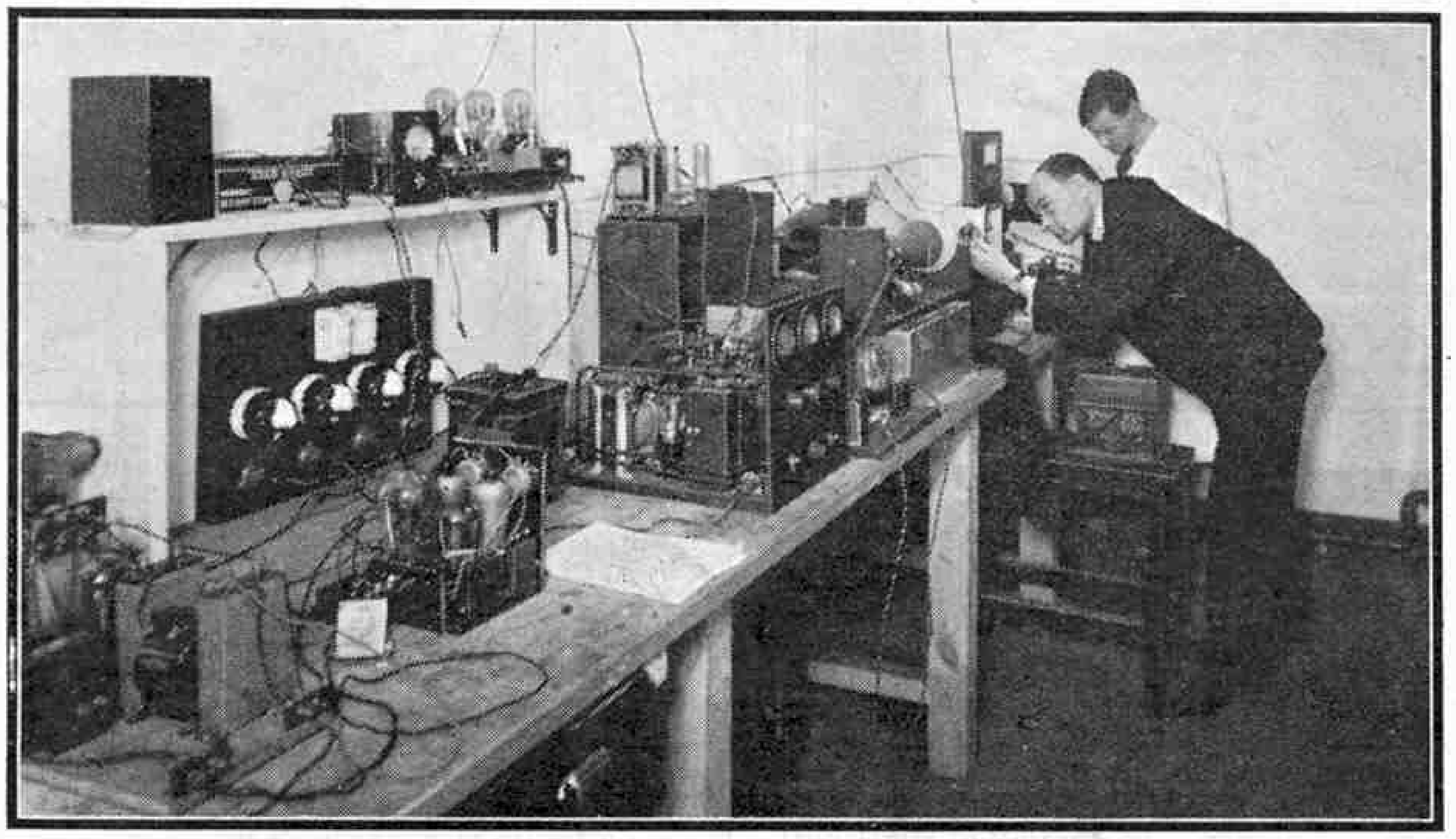
Some of the electrons pass through the aperture and these form a pencil or beam that strikes the fluorescent screen. Similar electric charges repel each other. The particles of this beam are themselves negatively charged and therefore have a tendency to spread out to form a diverging ray. In order to prevent this, and to concentrate the beam so that as many electrons as possible pass through the aperture in the anode, the part of the tube between the latter and the cathode is surrounded by a metal cylinder, named the Wehnelt cylinder after its inventor. This is given a negative charge by means of a battery and its repulsive effect causes the electrons passing through it to bunch together in the centre of the tube, and to concentrate upon a small area or "spot" of the fluorescent screen on its base.

The Wehnelt cylinder also provides a means of controlling the number of electrons passing through the opening in the anode. If its negative charge is great the beam is bunched tightly, and when the charge is reduced the beam is spread out so that fewer electrons pass through the aperture. If the varying currents in the aerial of a television receiver therefore are suitably amplified and allowed to vary the charge on the Wehnelt cylinder of the cathode ray tube, the effectiveness of the electron stream will change in a corresponding manner, and so cause variations in the intensity of the glow of the spot on the fluorescent screen. In other words, the light and shade of the scene or picture being televised is reproduced.

Next we must see how the modulated beam is made to build up a square of light. After passing through the aperture, it is projected between two pairs of plates that are fixed at right angles to one another in the neck of the tube. One of the two plates of each pair is connected to the anode.

If it is desired to receive television pictures, each made up of 240 lines, at the rate of 25 a second, the other plate of one pair is fed with current from a local source that is interrupted 6,000 times a second, this figure being obtained by multiplying 240 by 25. At the same time the second plate of the other pair, at right angles to the first, is supplied with current interrupted 25 times a second. The purpose of this is to cause the beam to sweep backward and forward across the tube and also to move up and down. In this manner it builds up a square of light on the fluorescent screen at the rate of 25 times a second. As the beam is being modulated at the same time, a complete series of pictures is presented to the observer.

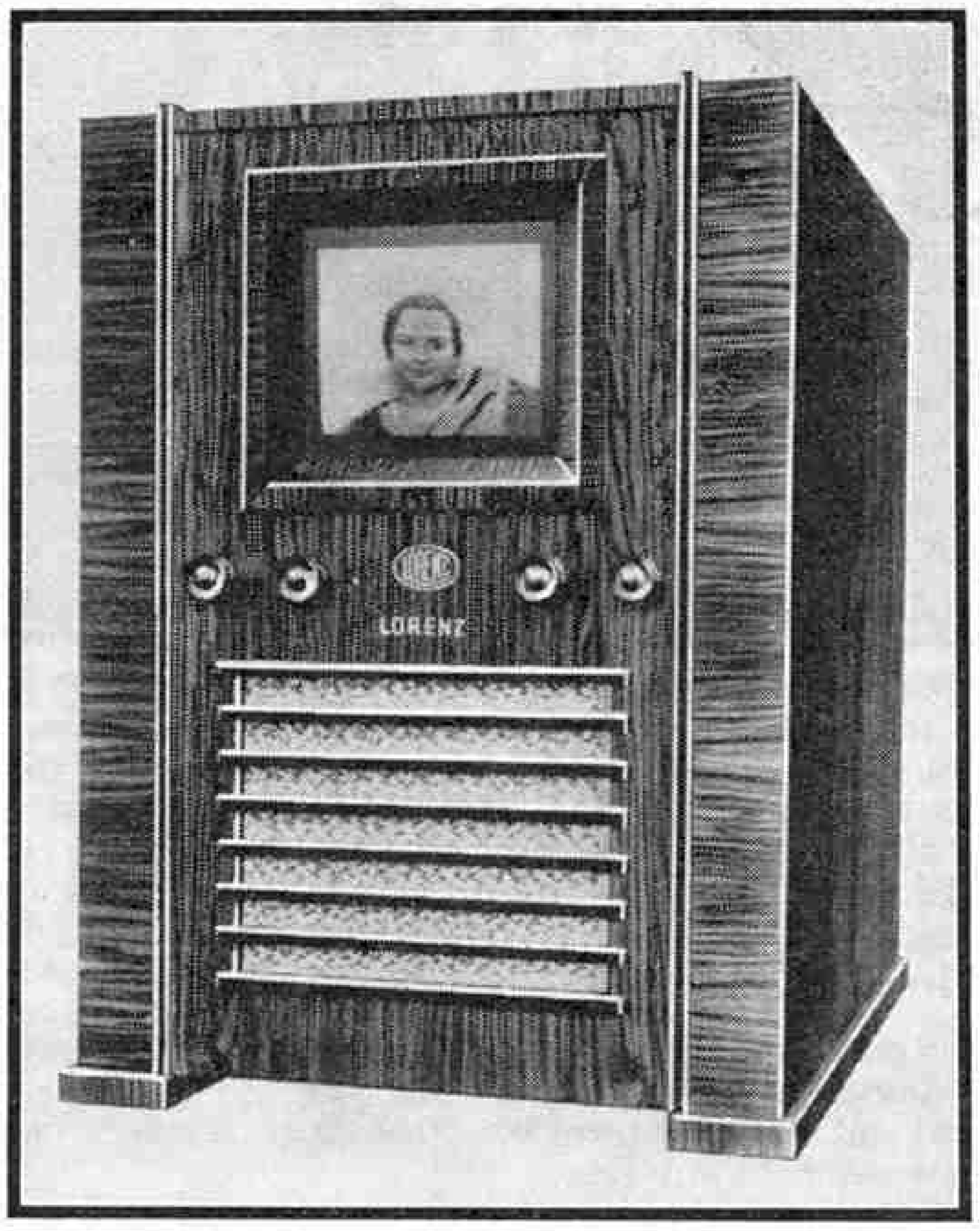
The necessary movements of the beam are brought about by an electrical device known as the time base. This consists essentially of an electrical condenser with an adjustable resistance, a battery and a glow discharge valve or a pentode. The deflecting plate in the cathode ray tube is in parallel with the condenser and discharge valve, and the battery is applied to the terminal of the condenser so as to charge it. When a certain voltage is reached the resistance of the lamp breaks down and the condenser is discharged through it.



Experimental work in progress in the Baird laboratories in connection with the latest developments in television reception. Photograph by courtesy of Baird Television Ltd.

The charge and discharge produces the following effect. As the condenser is being charged, a continually increasing voltage is impressed upon the corresponding deflecting plate, which attracts the beam towards it. At the proper voltage the lamp resistance breaks down and the condenser is discharged. The deflecting plate then loses its attractive power and the beam returns to its normal position near the second plate of the pair, which is permanently charged positively because of its connection with the anode. The condenser then again becomes charged, the beam is drawn towards the first plate and once more returns to its normal position when the discharge takes place.

This series of movements continues as long as the time base is in operation, and the movement of the electron beam that it brings about is too swift for the eye to follow. As the beam is pulled towards the deflecting plate of one pair and released it traces an up and down line the requisite number of times in a second. Another time base, with a slower rate of charge and discharge, acts upon the other pair of plates, pulling the beam from side to side 25 times in a second. In this manner the glowing spot on the fluorescent screen is made to cover the entire picture area, and it does this so quickly that the first impression has not been lost by the eye when the last one appears, so that the entire square appears to be illuminated. The pictures so built up are seen as a continuous record, as are those on a cinema screen, since they follow each other at the high rate of 25 a second.



A Lorenz-von Ardenne television receiver exhibited at the German Radio Exhibition in 1935. The picture is 7⅛ in. by 8¼ in. in size. Photograph by courtesy of "Wireless and Television Review."

This explanation deals with the simplest form of cathode ray tube and its operation in television receivers in which the picture is reproduced by varying the concentration of the electron beam. This plan has some disadvantages, however, and Manfred von Ardenne, a German scientist who has devoted much study to television problems, has invented a system in which the speed at which the beam travels across the fluorescent screen is varied instead. This is caused to move slowly where brightness is required and more quickly where a less brilliant result is to be produced.

The cathode ray tube has now been adapted for use in the transmission of television, its work in this being to transform variations in light received from a scene or picture to be televised into corresponding variations in electric current. These electric variations are then used to modulate the wireless waves on which the transmission is broadcast.

The first apparatus of this kind was invented by Dr. Vladimir Zworykin, an American scientist. It is called an Iconoscope, and in this country is used by Marconi-E.M.I. Ltd., one of the two companies providing television plant at the Alexandra Palace Station. The beam of electrons is produced by heating the cathode and is deflected by means of time bases in the usual manner, but it falls upon a plate set at an angle at the end of the tube and scans that instead of the base of the tube. The plate consists of a sheet of silver over the surface of which are scattered about 3,000,000 tiny globules of caesium, a soft metal that liberates electrons when stimulated by light. Behind the silver plate is first a sheet of mica, which acts as an insulator, and then a copper plate from which a wire leads to the amplifying system. This arrangement constitutes about 3,000,000 tiny electric condensers.

The picture to be televised is focussed on the silver sheet by means of a lens. Each globule of caesium then releases electrons, and the condenser of which it forms part therefore becomes charged. The greater the intensity or amount of light falling upon a globule of the metal, the greater its charge, and thus a sort of electric image of the scene focussed upon the silver sheet is produced. This is scanned by the electron beam, which travels methodically over the silver sheet, touching each globule of caesium in turn, and as it does so discharging the condenser of which it forms part. The discharge current flows through the copper plate at the back and thence to the amplifiers, and its variations in strength represent the variations in the intensity of the light falling upon the tiny areas of the screen to build up the picture focussed upon it.

A somewhat similar apparatus giving greater output is the Electron Camera invented by Philo T. Farnsworth, also in America. This has been developed in Great Britain by the Baird Television Development Co. Ltd., and its improved form, known as the Farnsworth Multiplier, will be used in the broadcasting service from Alexandra Palace that is to be operated by this company.

In the Electron Camera the scene to be transmitted is focussed on a plate, the surface of which is coated with material that emits electrons when light falls upon it. This plate is at one end of a vacuum tube and is negatively charged. At the other end of the tube is the anode, a smaller plate in which there is a minute opening. Electrons shot out by the cathode travel at high speed towards the anode, and electro-magnetic coils give the beam a scanning motion, so that electrons from each part of the image in turn pass through the opening and strike a collector connected to the amplifiers.

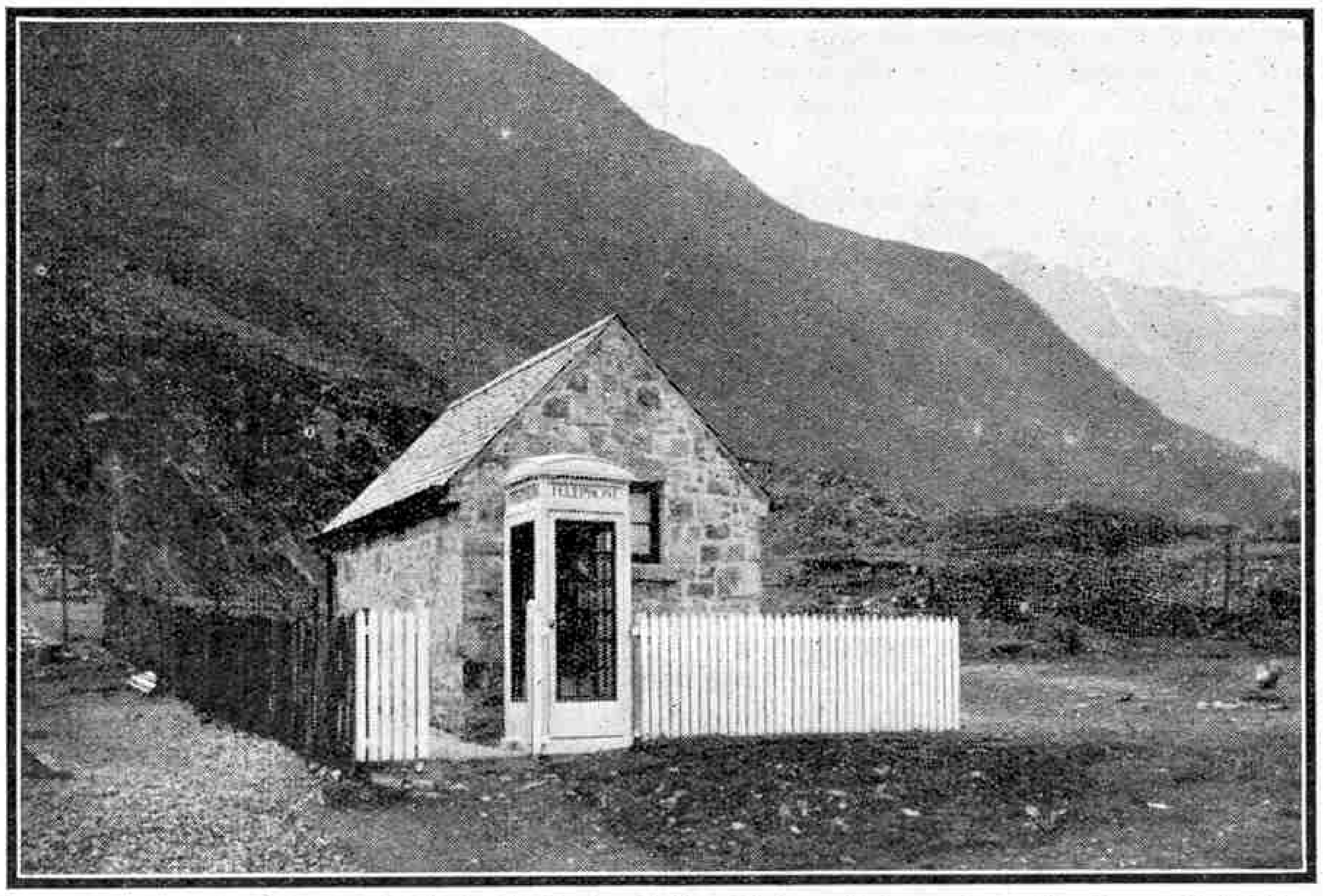
The programmes to be broadcast from Alexandra Palace are to be shared between the Baird Television Development Co. Ltd., and Marconi-E.M.I. Ltd., the two companies to which reference already has been made. The systems have different rates of scanning and give pictures of different sizes. In the Baird system scanning is at the rate of 240 lines for each picture and there are 25 pictures a second, while the sides of the picture will be in the proportion of four to three. The scanning is in strict sequence, that is each line follows the preceding one and there are 6,000 lines a second. In the Marconi-E.M.I. system there are also 25 pictures a second, but these are made up of 405 lines, and the ratio of their sides is five to four. Another difference between the two systems is that Marconi-E.M.I. scanning is interlaced, that is the picture is scanned first by 202½ lines and then by another series of 202½ lines that run in between those of the first series. It is claimed that this method eliminates flickering and in consequence gives a steady picture. As there are 25 pictures a second, the number of lines in the same period in the Marconi-E.M.I. system is no less than 10,125.

Miniature Automatic Telephone Exchanges

What must surely be the loneliest telephone exchange in Great Britain is illustrated on this page. It is at Ballachulish, in the heart of the Scottish Highlands, and is one of the new Rural Automatic Exchanges now being introduced by the General Post Office.

The telephone is as valuable in the country as in cities and in towns, and in emergencies the need for it may be even more pressing in a widely scattered area than in a place that is densely populated. Calls during the night hours are so infrequent in some villages and country areas that they do not justify the expense of keeping an operator on duty at the small exchange. The coming of the Rural Automatic Exchanges has solved the problem of providing a full service at all times, however, and many villages are now being equipped with them.

The building contains a set of line switches, selectors and other necessary equipment, and local subscribers can communicate with each other at any time by simply dialling the respective numbers. If a number outside the local exchange is required, connection with the nearest main exchange where operators are constantly on duty can be made by dialling "O." The mechanism used is of the standard Post Office type. Its maintenance calls only for the attention of a mechanic at intervals, and it works well, although often exposed to great changes of temperature in the small and isolated buildings in which it is installed. A public telephone kiosk usually is located outside the exchange, or at some convenient point, so that the benefits of the system are extended to all who live in the area.



The rural automatic exchange at Ballachulish in Argyllshire. Photograph by courtesy of the General Post Office.

Where Holidays may be Fine Days

It almost seems as if the best way to ensure a reasonably fine day in Rochdale, Lancashire, is to make that day a holiday. This suggestion is based on the fact that the average rainfall in that town is less on Sunday than on any other day of the week. In any case, this seems to be an interesting example of how weather can be modified to a slight extent, for it is probable that the volumes of hot gases rising from the factory chimneys of Rochdale on working days give the uplift required to raise clouds to higher and colder regions of the atmosphere, where their moisture is condensed into rain.

Another curiosity of our weather is the fact that there are certain times of the year at which rain has never fallen in London while records have been kept regularly. According to these records there has been no rain for 50 years in the mornings of 9th and 16th May and of 16th March, or in the evenings of 18th May and 3rd October. This of course is no guarantee that these periods will be fine in future years; but it is encouraging to learn that although there are periods of this kind that have always been fine, there are no corresponding ones that have always been wet.

A Halo without a Wearer

The halos that the best of us wear as the marks of our virtues are invisible, and halos in general are only seen in pictures and stained glass windows. There is at least one instance in which a halo could be seen plainly while its wearer was invisible or unknown, however, but in this case it surrounded a fragment of a chemical element instead of encircling a human brow.

This halo was found about 14 years ago in a piece of mica from Sweden. It has been known for many years that many specimens of mica contain small specks in which the colour has been lost. These marks show as concentric rings or halos when the mica is cut through them. They are due to the presence of minute amounts of radio-active elements, which act as guns of various calibres shooting out tiny particles to different distances. The range of each projectile, that is the radius of the halo it forms, enables the element producing it to be tracked down, but for years this halo defied all the efforts of scientific detectives to trace it to its source. Then it was discovered that it was due to a tiny fragment of a rare element known to them as samarium.

One reason for the failure to recognise the halo as that of samarium was that the element had not previously been suspected to be radio-active. Now we know that it does break up spontaneously, but it does so very slowly indeed, and a piece of the element would take more than a million million years to lose half its weight. It is impossible to measure its life directly by experiment, of course. The mica in which its halo was discovered is a laboratory in which this measurement has been in progress for ages, however, for the range of the projectiles the element shoots out is an indication of its durability.

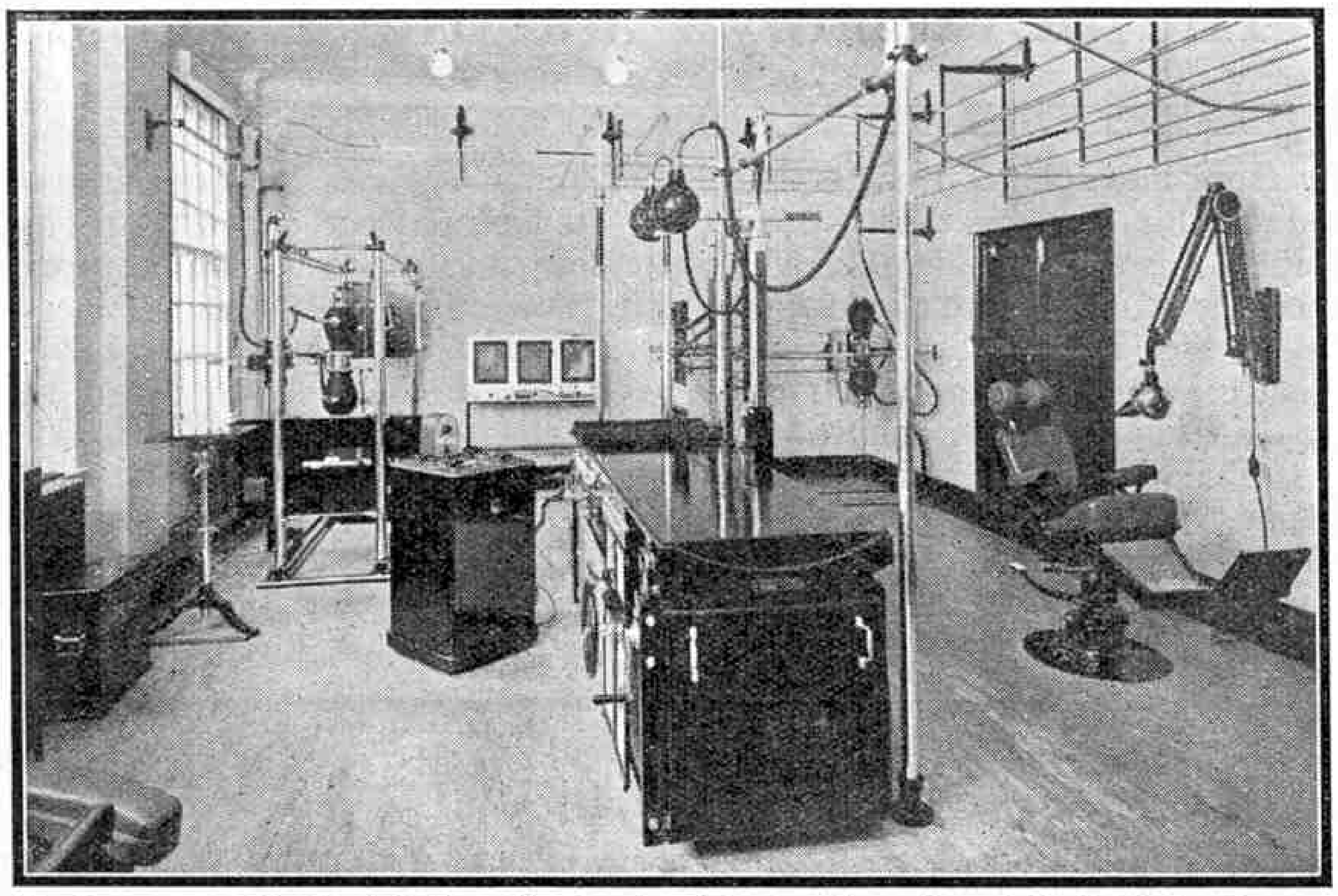
Game Animals in Northern Rhodesia

Northern Rhodesia appears to be comparatively well-stocked with game animals, although the number of these in South Africa as a whole is diminishing. A rough estimate gives 300 giraffes, 1,500 rhinoceroses and 3,000 hippopotamuses among the rarer creatures, and 12,000 elephants, 50,000 zebras, and 60,000 buffalos among those that are more numerous. The total animal population is believed to be about one million, and this, equally distributed, would average about four individuals to the square mile, or approximately the density of the human population. The elephants and buffalos have trebled in number during the past 30 years.

A Modern Radiographic Department

The upper illustration on this page shows a scene of a kind that may be familiar to some of my readers. It is a reproduction of a photograph of the X-Ray room of the new Radiographic Department of Ilford Ltd., at Tavistock Square, London, W.C.1, which was opened as recently as December 1935, and is thoroughly up-to-date in its equipment. In addition to the X-ray room itself the Department includes thoroughly up-to-date dark rooms for development of X-ray photographs, a studio for clinical photography, and lecture and exhibition rooms.

On the right of the illustration is a special wall unit for X-ray examination of the teeth. The patient undergoing this sits in comfort in the dental chair, and the small X-ray tube at the end of the hinged and jointed arm fixed to the wall can then be rotated round his head into various positions to enable radiographs, or X-ray photographs, of individual teeth to be obtained.

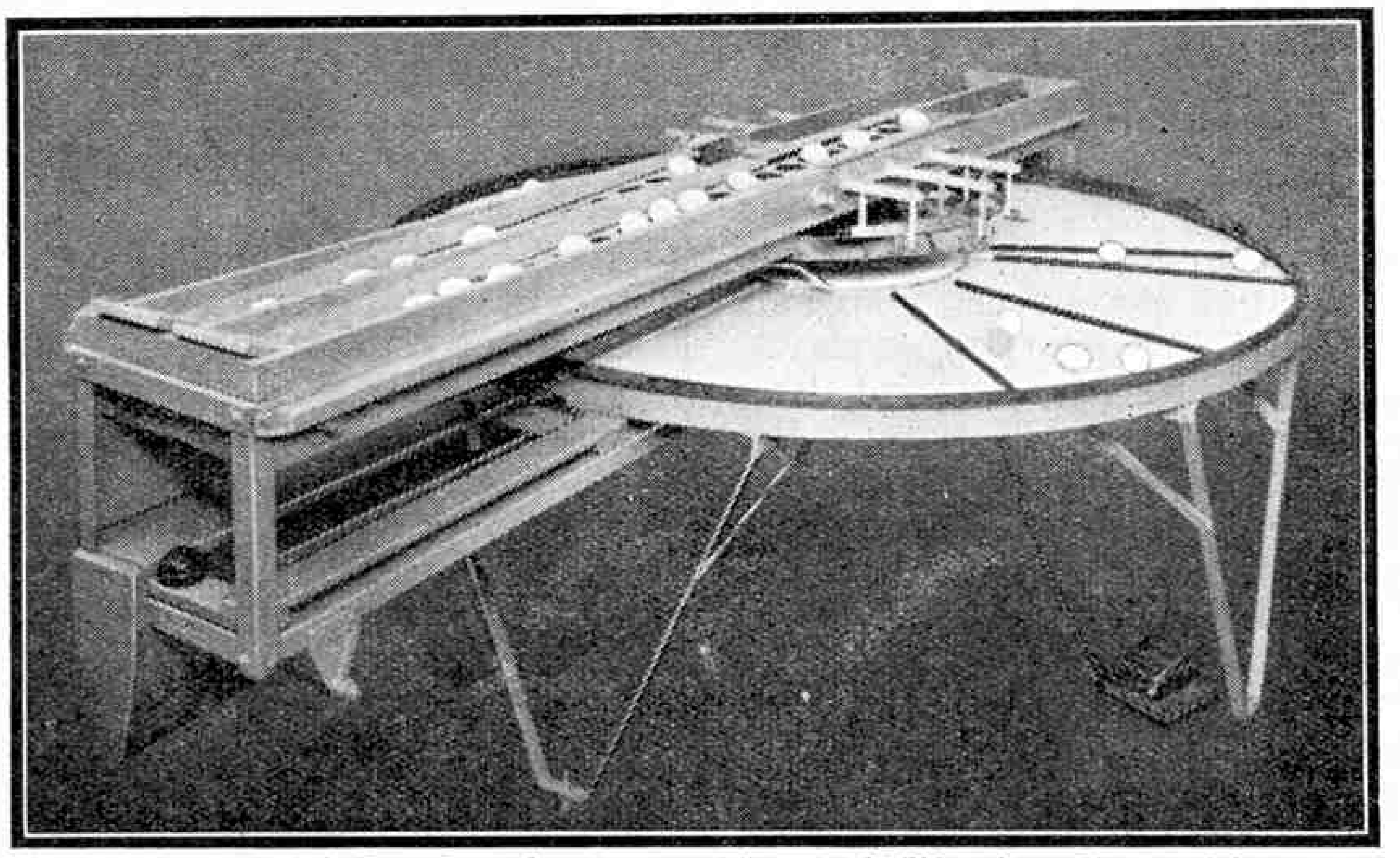


The X-ray room of the Ilford Radiographic Department, London, the equipment of which is described on this page. Photograph by courtesy of Ilford Limited.

The couch in the centre of the room is suitable for all work in the horizontal position. Its top can be turned to several angles and the photographs required can be obtained with the aid of the X-ray tube shown above it, or of an additional one placed underneath. In addition there are screening stands of various kinds, where the patient stands or sits between the X-ray tube and a fluorescent screen that glows when the rays fall upon it. On their way to the screen the rays pass through the heart or lungs of the patient or any other part of his body that requires examination, and the resulting picture or image on the screen can be studied closely.

One of the stands employed for vertical work is specially devoted to X-ray photography. It is fitted with an electrically-driven film holder so that stereoscopic films can be taken with great rapidity.

High voltages must be applied to current X-ray tubes, and the necessary supply is obtained from a transformer and valve rectifier in a separate room. The current is conveyed round the X-ray room by means of aluminium rails placed high up on the walls, where there is no danger of accidental contact with them. Shock-proof cables connect the rails with the X-ray tubes, all of which also are of the shock-proof type. The control table, seen on the left of the central couch, can be moved about the room to bring it near the point at which work is being carried out. It is fitted with a time switch that allows photographic exposures down to 1/50th of a second to be given.



A machine that automatically grades and counts eggs at the rate of 7,500 an hour. Photograph by courtesy of Bingham Appliances Ltd.

Grading and Counting 7,500 Eggs an Hour

We all know how very disappointing an undersized boiled egg can be, and appreciate the greater sense of comfort derived from the appearance on the table of one that from its bulk promises to be double yolked. The extent to which eggs vary in size is astonishing. Feeding and the living conditions of hens generally no doubt influence the size of their eggs, but the breed of the birds has something to do with it. White Leghorns lay white eggs that may be as much as 2¾ oz. in weight, while Rhode Island eggs are brown in colour and usually weigh less than 2 oz. Imported Egyptian eggs frequently weigh less than 1 oz.

The price of an egg depends largely on its size, which also determines the use to which it is put. For this reason it is necessary that eggs should be graded, or sorted into batches of different sizes or weights, before they are marketed, and the accompanying illustration shows a machine that is capable of doing this at the rate of 7,500 eggs an hour. The central feature of the machine is a rotating unit that automatically weighs the eggs as they are fed on to it by an endless conveyor belt, and delivers them to different sections or compartments of a table. Each weighing unit is balanced and adjusted to give a standard of accuracy within 1/32 oz., and the eggs are graded into four, five or six sections, or even more if desired, the weight of every egg in each section falling between definite limits. The machine is driven by an electric motor and if necessary it can be fitted with a counting mechanism that automatically records the number of eggs delivered to each compartment.

An Invisible Door

A year or so ago a window without glass was invented for use in the cabs of locomotives. The driver of an engine fitted with it simply looks out through a round opening in the front of the cab, and he can do so in perfect comfort because baffle plates set up currents of air that deflect wind, snow or rain.

Now the window without glass has been succeeded by a doorway without a door. Strictly speaking there is a door in this case, but it is invisible because it is simply a curtain of moving air. It has been used on a train in the United States to separate the kitchen from the dining car. The air is pumped out through slits on opposite sides of the doorway and is deflected towards the kitchen. Thus it prevents heat and odours from penetrating to the dining car, but offers no obstacle to the passage of waiters and conductors.

A Shock for the Fish

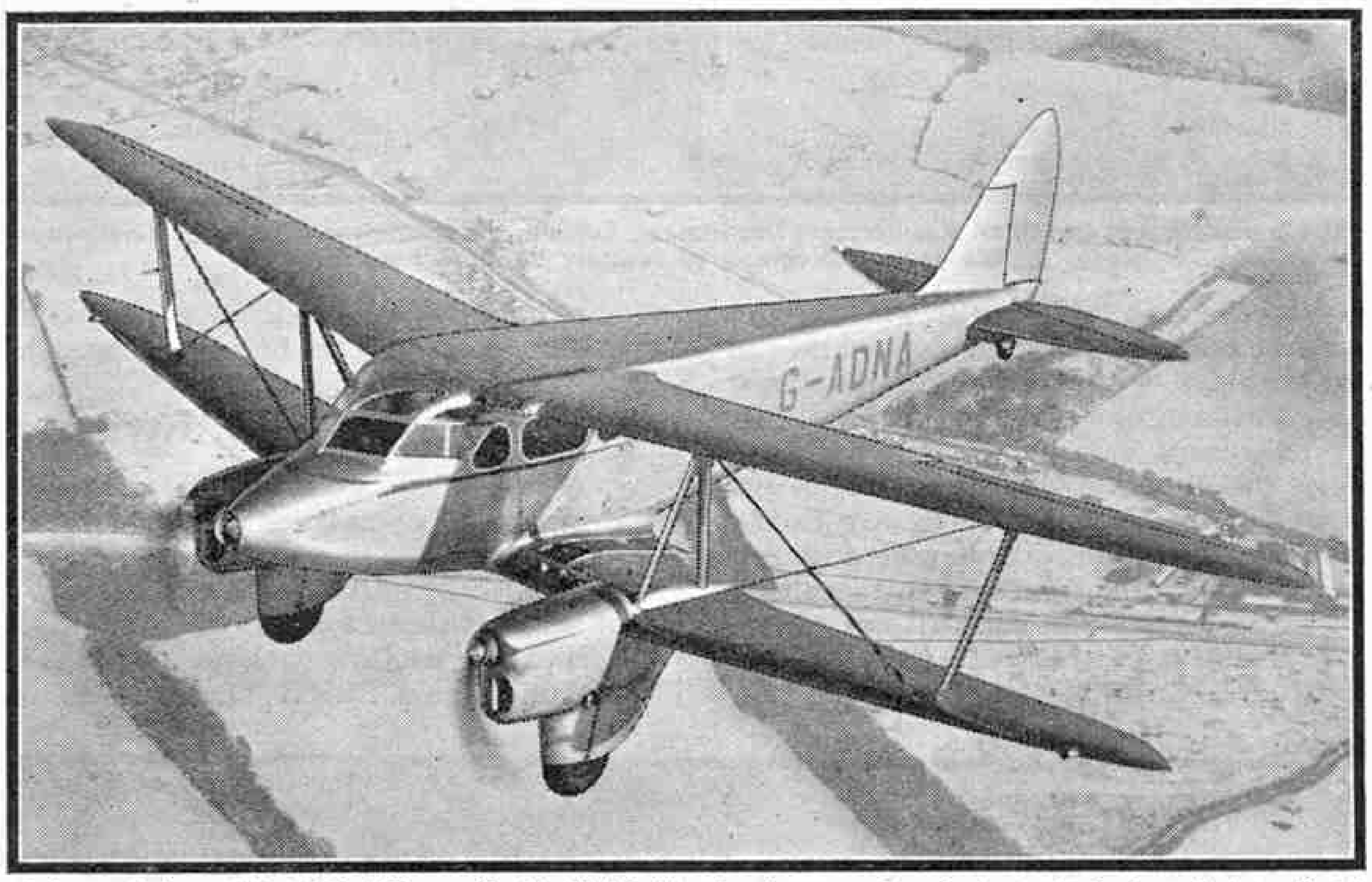
The description of these invisible barriers is a reminder that work on one of an electrical character is being carried out in this country. The object of the experiments is to electrify the greater part of a channel through which fish pass, in order to give them mild shocks that will divert them towards nets in which they can be caught.

It seems as if the problems involved in doing this have already been solved in America. There an engineer who wished to prevent fish from entering irrigating ditches suspended two sets of electrodes, consisting of cables or chains, in the water and passed a current between them. The result was a shock to the fish, and this was sufficient to deter them from further attempts to pass the barrier. There seems to be many possibilities in this remarkable scheme.

De Havilland Aircraft

The "Dragonfly" and the D.H.86A

ALTHOUGH slightly more monoplanes than biplanes have been produced in this country during recent years, the demand for biplanes is still considerable, as for many purposes it is almost essential that an aeroplane be fitted with two wings. A Service aeroplane, for instance, must not only be fast but also capable of carrying a good load at both high and low altitudes, and be able to withstand great stresses and strains while in the air. The larger total wing area of a biplane, although it involves a slight decrease in speed, gives the aeroplane both greater stability and carrying capacity. For these reasons most of the aircraft used in the R.A.F. and other Air Forces are biplanes. In commercial aviation the extensive development of internal air lines has been due largely to the production of special types of aeroplanes in which low horse power, low initial cost and economical maintenance are combined with high performance and high payload; and the majority of these types have been biplanes.



A forward view of the D.H. "Dragonfly" in flight. The slender nose, sharply tapered wings, and streamlined undercarriage and engine nacelles are very noticeable. The illustrations to this article are reproduced by courtesy of "The Aeroplane."

The numerous types of de Havilland civil and military biplanes produced have ranged on the military side from two-seater training machines to bombers, and on the commercial side from the lightest sports type to large air liners. The D.H.2, 4, 5, 6, 9 and 9A military types played parts of outstanding importance during the War and afterward, with the R.A.F. Early de Havilland successes in the commercial field were the D.H.34 and D.H.50 air liners, and later came the D.H.53, a light sports aeroplane with an engine of only 15 h.p.

In 1925 the company introduced the now famous D.H. "Moth," a two-seater open cockpit biplane fitted with a 100 h.p. "Gipsy I" engine. The high efficiency of this aeroplane led to its adoption by the Royal Air Force and many Air Forces abroad, and it has also been used extensively by flying clubs and private owners in all parts of the world, no less than 4,000 "Moths" being sold during the 10 years this type was in production. In that period various types were developed from the "Moth," and the latter was withdrawn last year, when the "Hornet Moth" cabin biplane was introduced. This aeroplane was described in the *"M.M."* of February last.

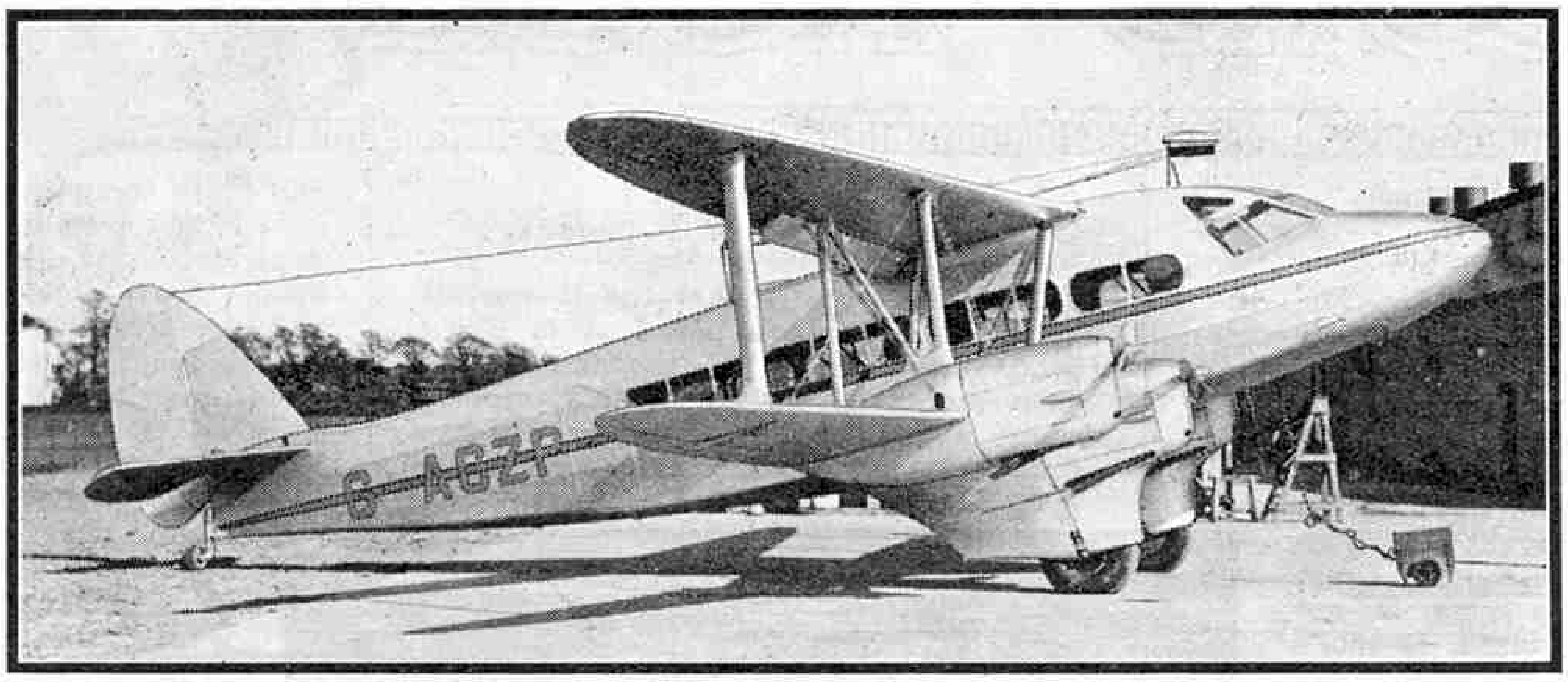
In 1933 two very successful new D.H. types, the "Dragon" and the "Express Air Liner," made their appearance. The "Dragon" was a six-seater passenger or freight-carrying aeroplane fitted with two 130 h.p. "Gipsy Major" engines. It was an immediate success by reason of its high payload capacity and high speed in relation to its low horse power. An improved "Dragon" called the "Dragon Rapide" was produced shortly afterwards. The "Express Air Liner" was specially designed to comply with the requirements of the Australian Government in connection with the Singapore-Brisbane section of the Empire air route, and a detailed description of this fine aeroplane was given in the December 1934 *"M.M."*

The latest de Havilland products are the "Dragonfly," a smaller version of the "Dragon Rapide" and the company's 90th design, and the D.H.86A, an improved version of the "Express Air Liner."

The "Dragonfly" is a twin-engined unequal-span biplane, the upper wing being 43 ft. in span and the lower one 38 ft. 6 in. It is a five-seater aeroplane, as experience has proved that this amount of accommodation is the most suitable for the privately-owned family aeroplane and for the air taxi, two purposes for which the "Dragonfly" is ideal. The arrangement of the seating is two in front, a single seat immediately behind them and opposite the cabin door, and a seat that extends right across the back of the cabin and provides room for two persons. There can be no comfort without spaciousness, and the cabin is 10 ft. in length from rudder bars to rear, 5 ft. in height and more than 4 ft. in width; each passenger therefore has 40 cu. ft. of space. Either cool air from individual adjustable ventilators, or warm air from engine exhaust muffs can be admitted at will. The windows are of a light and non-splinterable composition and extend the full length of the cabin; they are crystal-clear and provide the perfect view that adds so much to the attraction of air travel.

A new system of soundproofing is used that excludes noise throughout the range of audible frequencies, resulting in a cabin in which a party can cruise all day without suffering from noise-fatigue at the end of it, and enjoy normal conversation at any time. Preliminary tests of the system proved so satisfactory that it will be adopted in all future de Havilland aircraft. A shelf for light articles is situated above the back seat, and behind the cabin is a luggage locker that is reached by an outside door on the starboard side of the fuselage.

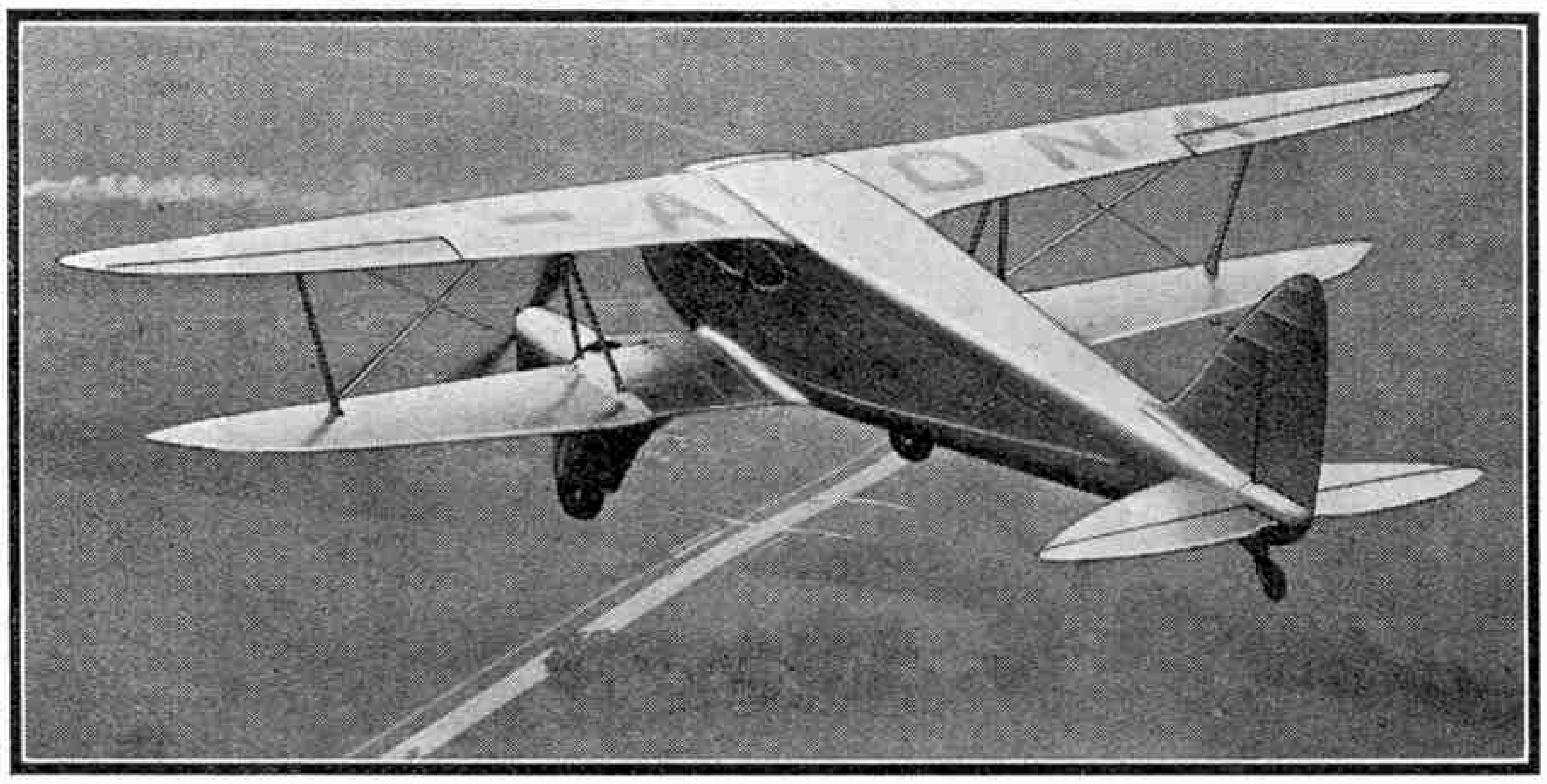
The two front seats in the cabin are spaced apart so as to be easily accessible. When there is only one pilot he occupies the left seat, and the central control column therefore has a fixed branch to the left, this branch being surmounted by the usual segmented wheel by which the pilot works the column. When there are two pilots to share the flying, a "stick" with a triangular handle is plugged in as a right-hand branch of the control column, for the second man. Throttle and altitude controls are on the left, and two rudder bars are provided. A convenient lever operates the "Comet" type split flaps fitted to the trailing edge of the centre section of the upper wing. Ailerons are also fitted to this wing. The wheel brake lever is of a new type and protrudes from the dashboard. It applies the brakes together, and when left partly on brings them under differential control by the rudder bars for steering on the ground.



The D.H.86A Express Air Liner, developed from the D.H.86 type used by Qantas Empire Airways Ltd., on the Singapore-Brisbane section of the England-Australia air service.

The fabric-covered fuselage of the "Dragonfly" is modelled upon that of the famous D.H. "Comet." The fin of the tail unit is an integral part of the fuselage and is covered with plywood, but the other tail surfaces are fabric-covered, with all controls partly inside the structure.

The undercarriage is of the divided type and has Dunlop low-pressure wheels fitted with powerful brakes. Each undercarriage leg is situated beneath an engine of the aeroplane, and both leg and engine are covered by a deep, streamlined fairing that merges into the underside of the lower wing. The upper portion of the fairing forms the engine nacelle, of course, and is hinged on the top centre line so that either side can be lifted up like the bonnet of a motor car, for attention and servicing.



Another view of the "Dragonfly" in the air. This machine is the 90th de Havilland design.

The two engines of the "Dragonfly" are 130 h.p. D.H. "Gipsy Majors," a type that has proved its high qualities in many notable flights, including 10 across the Atlantic, and in hundreds of thousands of hours of commercial operation. The engines are mounted, in rubber blocks, to quickly detachable welded steel-tube bearers at each end of the centre section of the lower wing. This system makes for great strength and economy of weight. Each engine has a 3½-gallon oil tank in the fairing behind it, and a 30-gallon tank adjacent to it in the wing. These four tanks constitute the standard supply and give the machine a range of 625 miles, which is more than sufficient for normal use. It occasionally happens that a greater range is required, and an additional 25-gallon tank can be installed under the rear seat in the cabin for use when maximum payload is not carried. With this additional tank in use the range of the machine is increased to about 885 miles.

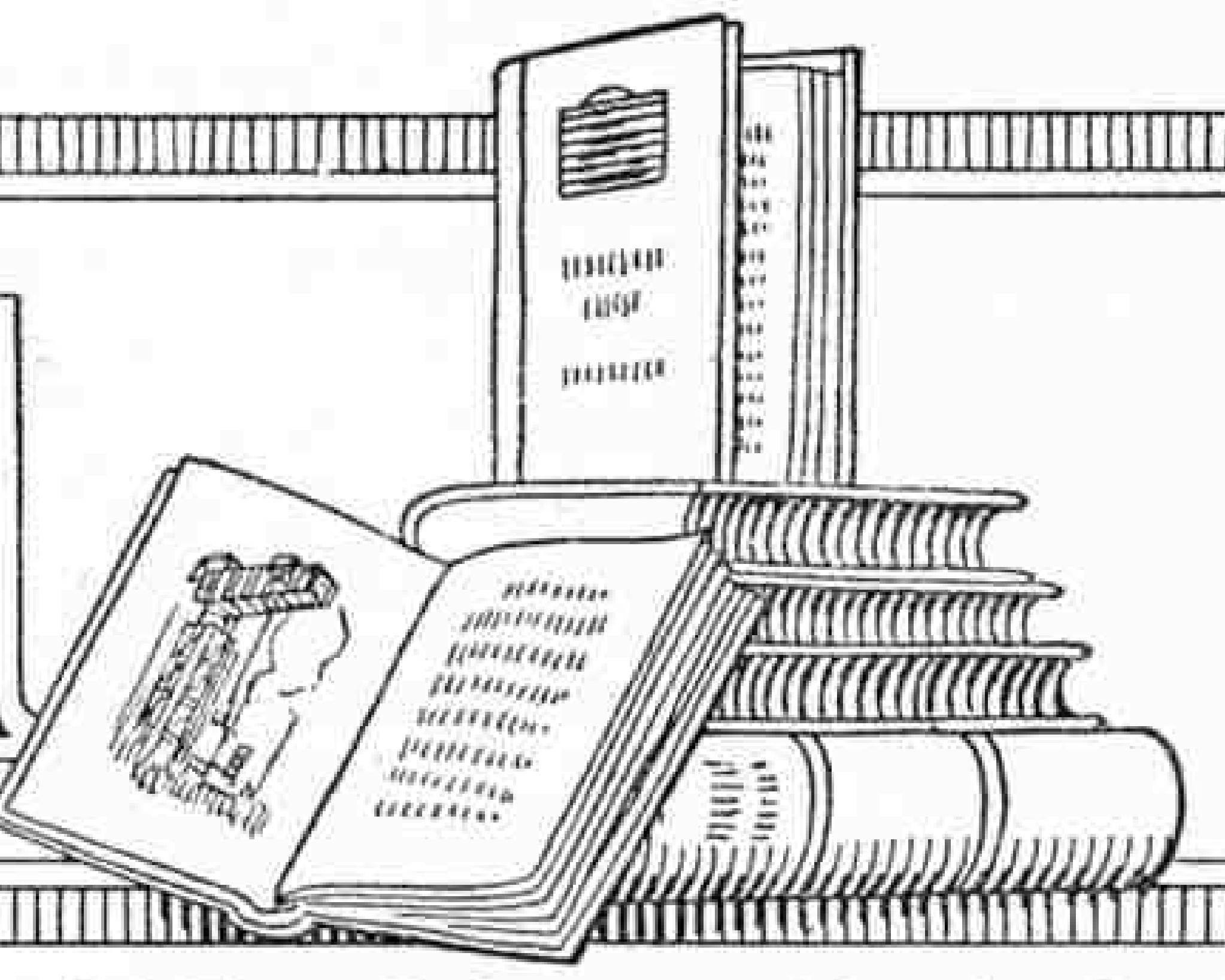
The D.H.86A Express Air Liner is a much bigger aeroplane than the "Dragonfly," as it is intended for use on long-distance commercial air services. It is, as stated earlier, a development of the type that has been in service during the past 18 months on the Singapore-Brisbane route operated by Qantas-Empire Airways Ltd., and it is also employed on Continental services of Imperial Airways and on several internal air routes in Great Britain.

The overall length of the D.H.86A is 46 ft. 1¼ in. and the height is 13 ft. The wings are 64 ft. 6 in. in span, and are of normal construction, consisting of wooden spars and spruce ribs covered with plywood and fabric although a tubular metal spar is used on the centre section as far as the inner engines. Ailerons are provided on both upper and lower wings, but only the lower ones are connected directly with the controls in the cockpit. They are joined to the upper ones by a streamlined steel tube, and thus when the bottom ones are moved those on the top have to move in unison.

The fuselage consists primarily of a three-ply box, but it differs from most fuselages by having the plywood inside the box, and the spruced longerons, struts and stringers outside it. There is then a covering of fabric, and the space between it and the three-ply is filled with special sound-insulating material. The pilot is accommodated in the nose of the fuselage, in a cockpit provided with a non-splintering glass windscreen and open side panels. The cockpit is separated from the cabin by a bulkhead in which is a door giving communication between the two compartments. Various arrangements of the passenger accommodation are available. They range from a long-distance luxury model with armchairs for nine passengers and a folding seat for a tenth one, to a "joy-riding" model designed to carry 16.

The four engines of the D.H.86A are carried in nacelles mounted in the leading edge of the lower wing. The two legs of the undercarriage are immediately beneath the inner engines and their coverings are one with the engine nacelles, as in the case of the "Dragonfly." The machine is available with either standard "Gipsy Six" engines and ordinary airscrews, or with the new Series II "Gipsy Six" engines and de Havilland controllable-pitch airscrews.

Books to Read



"Canoeing for Beginners"

By A. R. Ellis

(Brown, Son and Ferguson Ltd. 1/- net)

Canoeing is described by Mr. Ellis as a thrilling and adventurous recreation, and he offers his account of its essentials as the key to one of the finest and healthiest sports in the world. Although the book is small enough to be slipped into the canoeist's pocket it covers the entire subject, from acquiring a canoe to touring Great Britain in it. The sport is not costly. A canoe can either be made or bought, and the author gives useful advice on the various types available, paying special attention to the lightweight folding canoes that are steadily becoming popular.

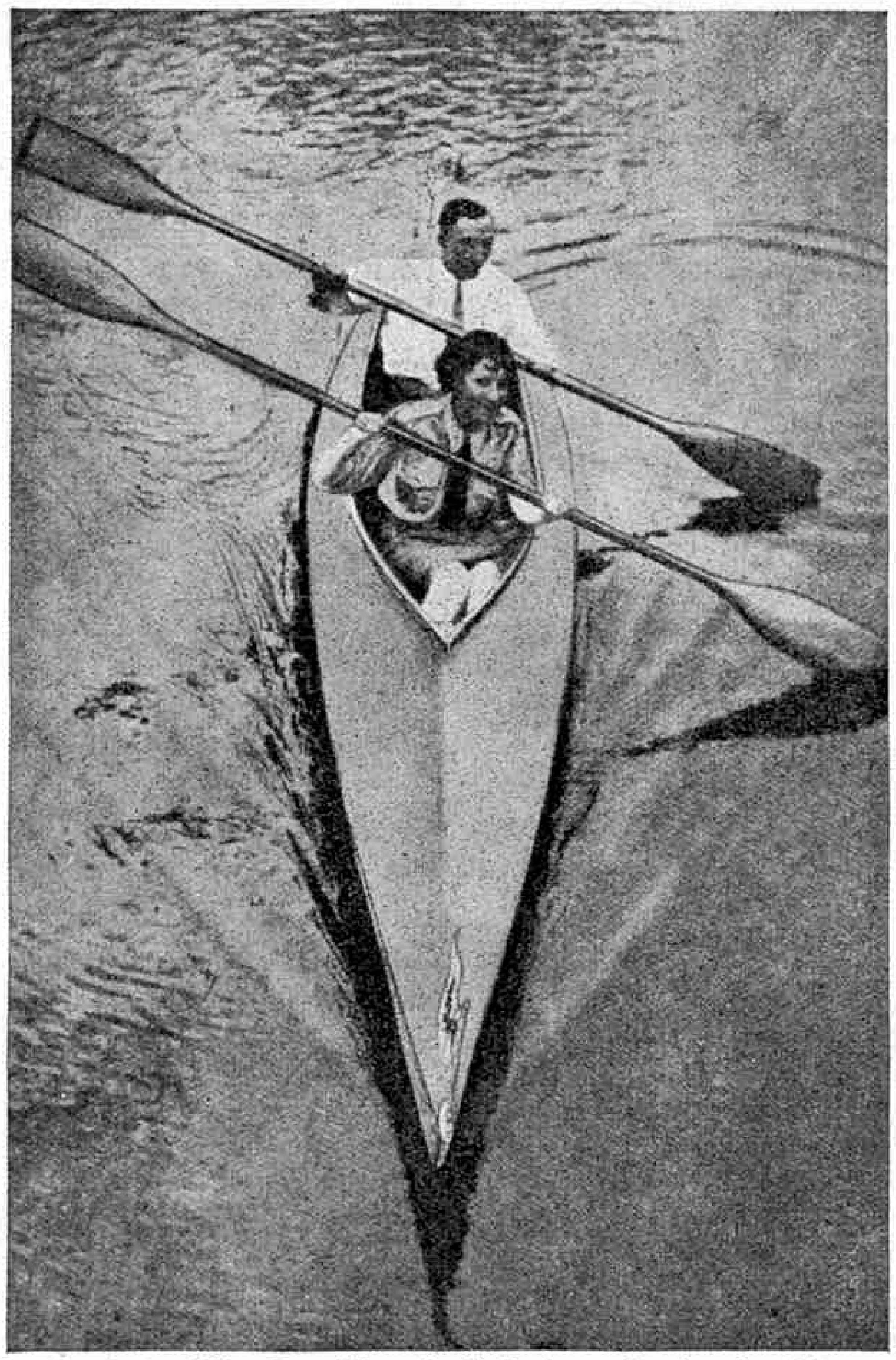
Having acquired a canoe, the next thing is to learn how to use it, and here again the author is eminently practical. He is emphatic that a knowledge of swimming is essential, not because canoes are difficult to manage or liable to be overset easily, but because an attractive part of the sport includes the negotiation of such obstacles as weirs and rapids. This topic occupies the next chapter, which is packed full of valuable hints on canoe management in rough or broken waters. Suggestions for river and canoe trips follow, and the booklet ends with a brief but adequate account of rights and restrictions on the waterways of Great Britain.

"Modern Alchemy"

By Dorothy Fisk. (Faber and Faber. 6/-)

One of the greatest marvels of modern science is the achievement of the dream that for centuries was pursued by the alchemist—that of turning base metals such as lead and tin into silver or gold. As our knowledge of chemistry advanced, the possibility of transmutation was laughed away. In recent years we have discovered that after all the alchemists were right in one sense, for certain elements can be changed into others, and a few, such as radium, actually change themselves. Only very minute quantities of certain elements have been transformed, however, and we have not discovered how to make gold.

In this well-written book Miss Fisk covers the entire subject from the strange and mysterious methods of the alchemists to the discovery of radio-activity and the latest laboratory transmutations. The book is thoroughly up to date, and the story ends with the astonishing feat, accomplished by Professor Fermi, an Italian scientist, of building up an entirely new element that so far as we know has no counterpart in any form in Nature. Useful diagrams in the text help the reader to visualise the astonishing changes dealt with.



Synchronised paddling. From "Canoeing for Beginners," reviewed on this page.

"Speed on Salt"

By G. Eyston and W. F. Bradley

(B. T. Batsford. 5/- net)

It is only recently that the Bonneville Salt Flats have been heard of in Great Britain as a result of the magnificent achievements of Sir Malcolm Campbell, George Eyston and others in the Autumn of 1935. Even now they are but a name, and the history and the nature of the great American Salt Desert are little known to Europeans.

In a foreword Sir Malcolm Campbell refers to these vast Salt Flats as "the only spot on the face of the earth where one can be assured of a straightaway run on a dead flat surface under conditions which will allow of speeds of 300 m.p.h. and upwards being achieved with comparative safety." He expresses the opinion that the Salt Flats "will be the future testing-ground of those inevitable developments in racing engines on whose results we shall base the practical everyday lessons which will govern the motor car, and to a certain extent the aeroplane of the future."

The book describes the early days of the Salt Flats, the journeys of the pioneers who risked their lives in attempts to cross this waterless waste, the gruelling experiences of the "Forty-niners" in their rush for gold, and the tragedy of expeditions lost for months without food. The authors give vivid descriptions of the speed record attempts made by Ab Jenkins, of Sir Malcolm Campbell's run of over 300 m.p.h., and the achievements of their own team, while George Eyston has contributed a thrilling account of his own personal experiences at the wheel when capturing the world's 24-hr. record. The detailed description of their exciting task is prefaced by an amusing account of their journey to the Salt Flats and the life in the little village which became their headquarters.

The large illustrations, many of which have not been published before, add greatly to the interest of this fascinating book, and show every phase of the speed records.

"Electricity for Boys"

By Ellison Hawks

(Ivor Nicholson and Watson. 7/6 net)

In spite of the fact that electricity is now used on an enormous scale for lighting and heating and for the production of power, it remains a mysterious force in the operations of which boys of all ages are so greatly interested that they cannot help wishing to know more about it and its wonders. The ordinary school book on electricity scarcely satisfies their needs, but these are admirably met in "*Electricity for Boys*," which deals faithfully with the story of electricity, and also shows how it is used for locomotion, telegraphy and telephony, wireless, television and the production of X-rays.

Stress is laid on the practical side of electricity. Every boy enjoys doing and making things for himself, and ample directions are given for making simple apparatus from homely materials and Meccano parts with which successful experiments can readily be carried out. The electrical devices dealt with in this manner include motors and dynamos, electric bells and alarms, telegraph and telephone instruments, and wireless receivers, all of which work in a very satisfactory manner.

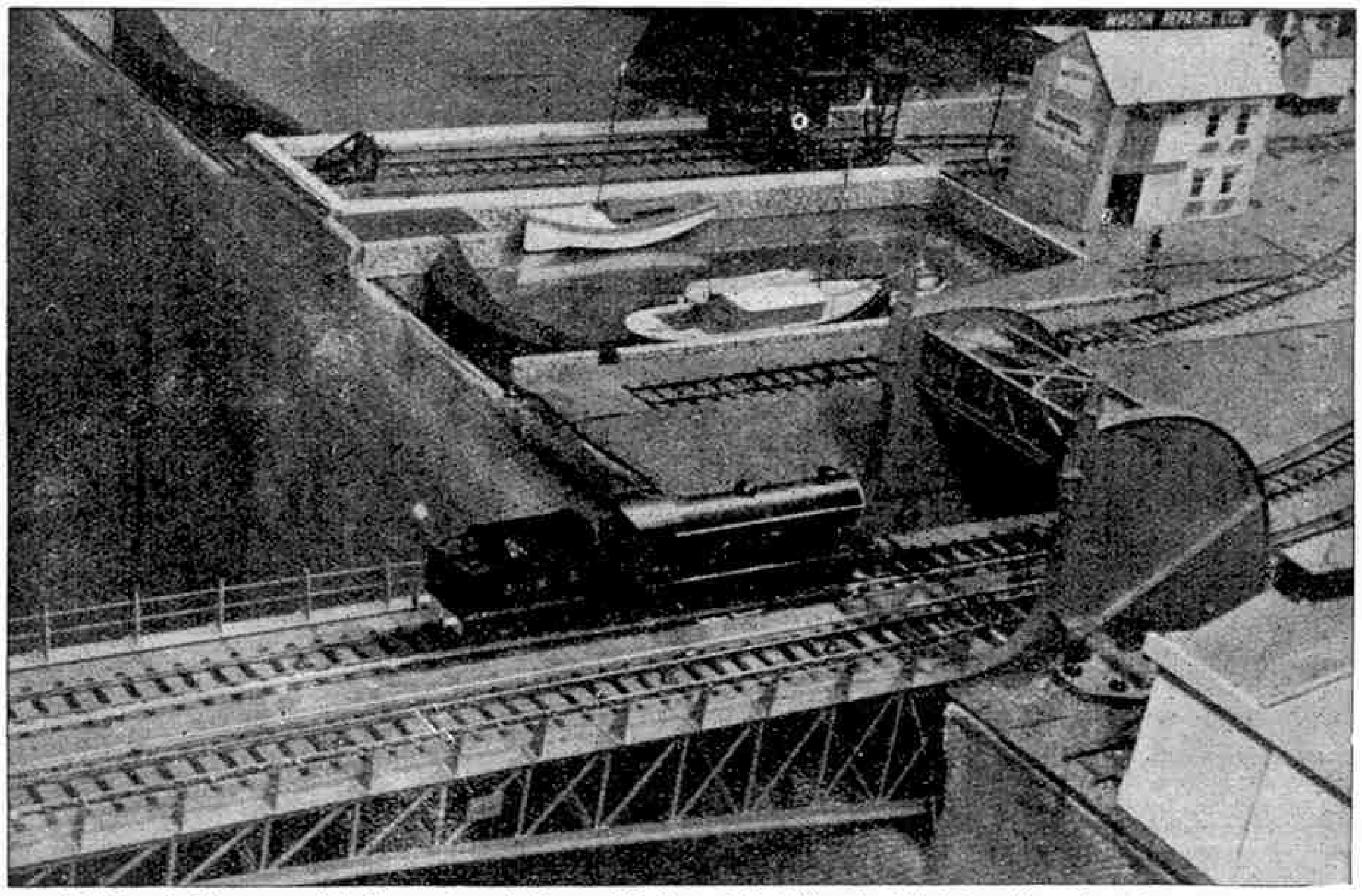
The book is written with the care and knowledge of boys' requirements that we have learned to expect from the author, and provides a store of absorbingly interesting reading as well as scope for the best kind of experimental work. It is copiously illustrated by means of 31 plates covering every phase of the applications of electricity, together with 214 drawings and figures in the text that show how electrical apparatus works, or simplify the task of the reader in following the instructions given for experimental work.

"Railway Modelling in Miniature"

By Edward Beal

(Percival Marshall and Co. Ltd. 3/6 net)

This interesting publication is described on the title page as "a practical handbook on the planning, building and operation of miniature railways, with special reference to 'OO' and 'HO' gauges"; and it certainly lives up to the purpose expressed in this description. Reference to the "OO" and "HO" gauges may puzzle readers who are not aware that these are the terms used to distinguish models of two different scales that run on the same gauge of lines—$\frac{5}{8}$ in., or exactly half that of Hornby Gauge "O" Rails. But the book can be read with profit, and many of the hints obtained in it can be applied, by owners of gauge "O" and larger layouts. Mr. Beal is himself a miniature railway owner and many of the photographs of his line give convincing proof of the soundness of his advice. In addition to these and other photographs there are innumerable sketches and drawings that illustrate clearly the various points that are dealt with.



A lifting bridge on a OO-Gauge layout. From "Railway Modelling in Miniature," reviewed on this page.

"Sands, Clays and Minerals"

(Vol. II. No. 4. 3/6)

Edited by A. L. Curtis

The current issue of this unique and interesting journal is larger than any of its predecessors and fully maintains the interest of previous numbers. As usual, it contains a wealth of original contributions by experts in the subjects dealt with. Some of these are highly technical, but there are many that will attract the ordinary reader of the "*M.M.*" with scientific leanings.

Among the articles of general interest may be noted one on the extraction of radium from the ores found in the far north of Canada and its preparation for medical and surgical use in hospitals; and an informative contribution on modern rotary drilling in oilfields. An attractive account is given of the use in industry of black diamonds and of stones that because of their colour or other flaws are of no value as gems. Other articles deal with gold mining in Southern Rhodesia, East Africa and the Gold Coast, and with the minerals used for colouring glass and enamels. Original photographs are freely used to illustrate these and other contributions that help to make a very attractive issue.

A large proportion of the contributions to this issue are concerned with the extraction and treatment of minerals found in various parts of the British Empire. In this connection the Editor makes a strong appeal for better use of the Empire's mineral resources, and points out that their development would lead to increased activity in shipping, shipbuilding, coal mining and other industries. An interesting summary of recent production of the various minerals found in the Empire goes far towards justifying his appeal.

"Living Dangerously"

(George Allen and Unwin. 7/6 net)

This book contains 37 stories told by some of the world's greatest adventurers, who have recorded for their readers experiences of dangerous living in various parts of the world on land or sea, or in the air. All are true stories originally broadcast from the B.B.C. Empire station at Daventry, and now collected in book form by Mr. Cecil Madden.

Each story is complete in itself, and the writers include men who have chosen difficult and dangerous careers, among them explorers, deep sea divers, news photographers, and those who have climbed mountains, sailed the sea in small boats, and indulged in various hobbies and pursuits. These have led them into hazardous and exciting situations, and their readers share in the thrills of the adventures.

Mr. George Eyston, the famous racing driver. From "Speed on Salt," reviewed on the opposite page.

"1001 Questions Answered About Your Aquarium"

By I. N. Mellen and R. J. Lanier (Harrap. 10/6 net)

There must be few readers of the "*M.M.*" who have not kept fish in a small home aquarium. Many of these no doubt have longed to go further with this increasingly popular hobby, especially since the introduction of the heated tank, in which the brilliantly coloured fish that normally live in tropical waters can be kept with success. They will find ample information on their hobby in this book, as will more experienced owners of aquaria. It deals not only with indoor tanks, whether for fresh or salt water, but also with garden ponds; and a useful chapter is included on the keeping of amphibians and reptiles, including baby alligators.

Considering the valuable material contained in this book, it is regrettable that it takes the irritating form of question and answer. One had thought that this method of bookmaking had vanished for ever. It inevitably results in a large proportion of questions and answers that are not of the slightest interest to anybody, and makes it difficult to find the exact subject on which one seeks information. A further drawback for British readers is that the book deals specifically with aquatic conditions in America.

The book is attractively illustrated by a large number of photographs and drawings of interesting fish and other inhabitants of aquaria, and includes three coloured plates of beautiful fish for the tropical tank.

"The Ancient Bridges of Wales and Western England"

(Architectural Press. 6/6 net)

Of all engineering works bridges seem to have the most persistent fascination, and this applies not only to the immense steel structures of the modern builder, but also to the more modest but delightful stone bridges of the past. The author of this book has made a complete survey of the ancient bridges of England and Wales. He has already described the results of his work in various parts of England in previous volumes, and now takes up the story of the ancient bridges of the west, from the Mersey down to the Severn and its tributary the Avon. This area of course includes Wales and in it there are many bridges of outstanding interest that in the course of time may almost be said to have become part of the wonderful scenery to be found there.

It is impossible in a short note to indicate even a few of the more attractive or important of the structures dealt with, but two that are outstanding are the ancient Dee Bridge at Chester, and Monnow Bridge at Monmouth, the only bridge in the country that still has a fortified tower or gateway on it. The stories of the many and varied bridges described are well illustrated by means of 90 excellent photographs.

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HORNBY SPEED BOAT No. 1. "HAWK." Price **2/11**
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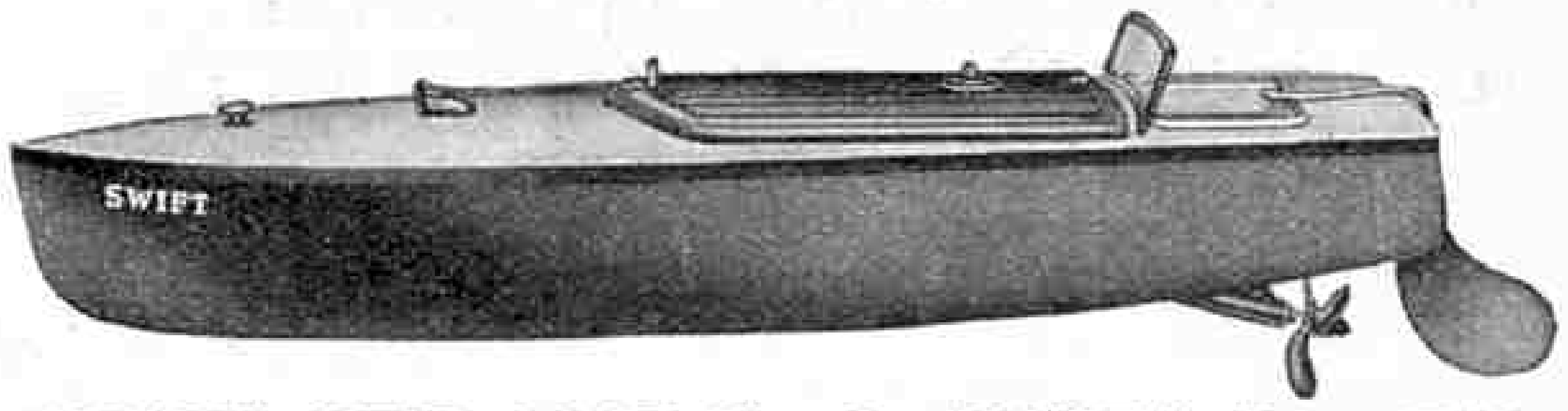
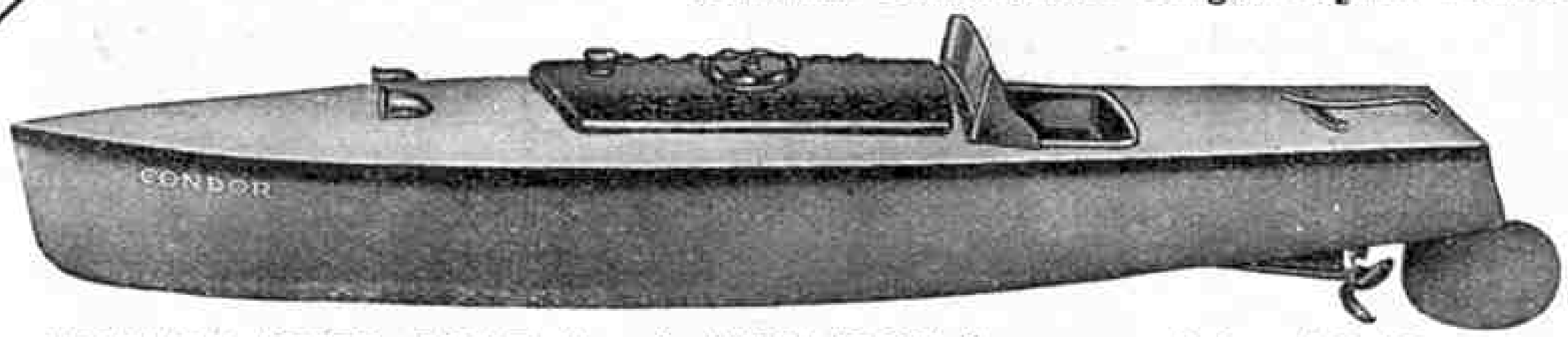
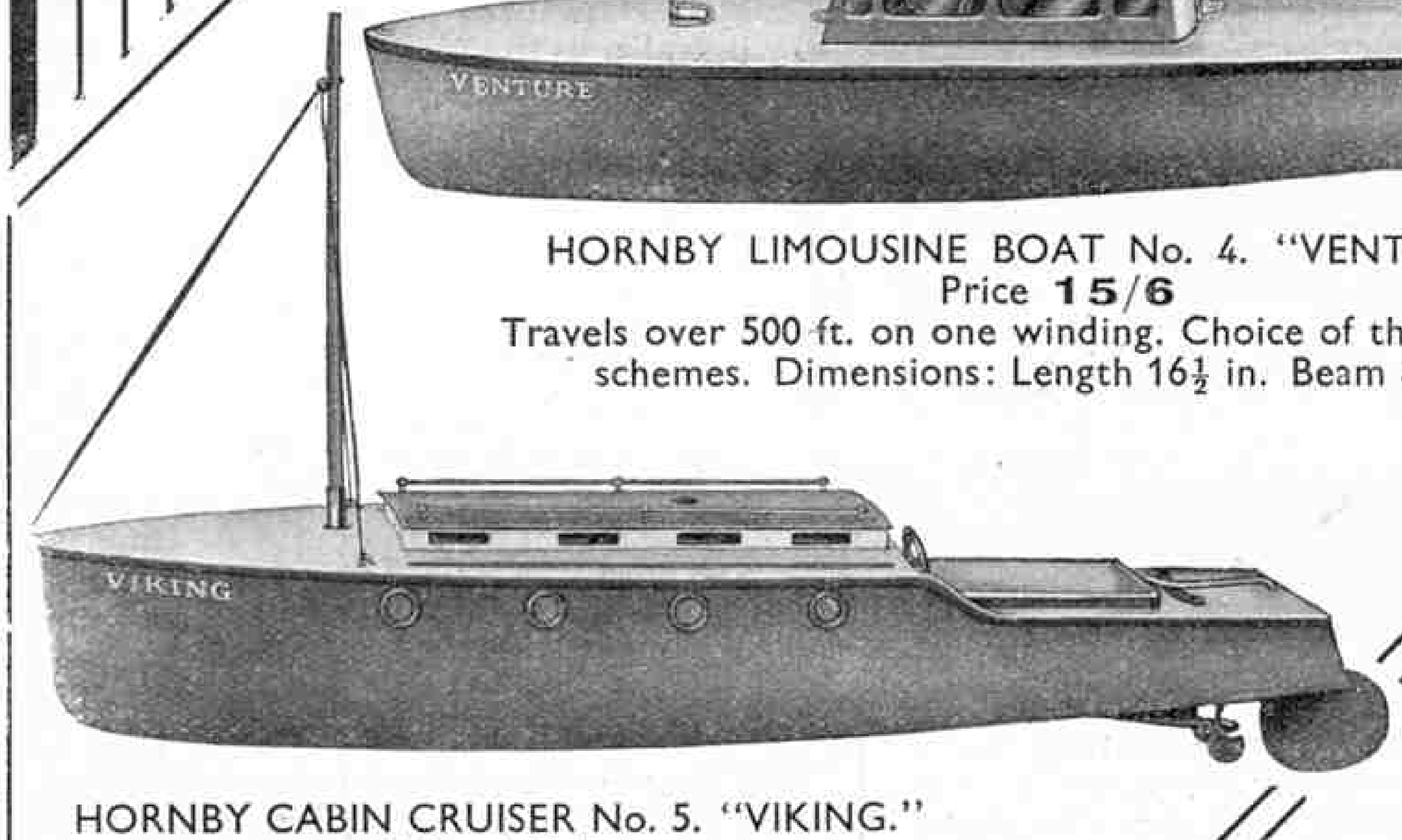


HORNBY SPEED BOAT No. 2. "SWIFT." Price **7/6**
Travels over 300 ft. on one winding. Choice of three colour schemes. Dimensions: Length 12½ in. Beam 3 in.



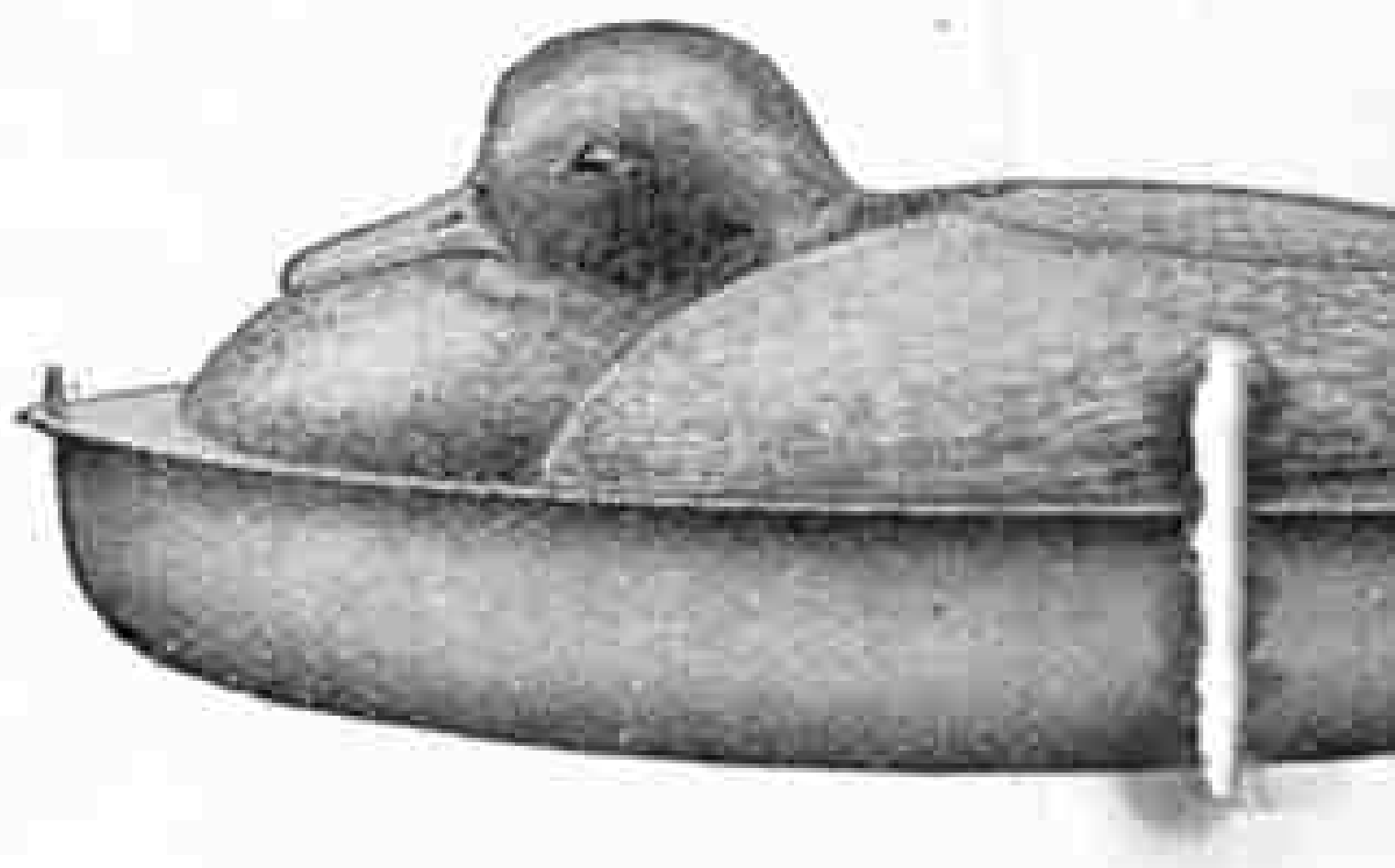
HORNBY SPEED BOAT No. 3. "CONDOR." Price **12/6**
Travels over 500 ft. on one winding. Choice of three colour schemes. Dimensions: Length 16½ in. Beam 3½ in.

HORNBY LIMOUSINE BOAT No. 4. "VENTURE."
Price **15/6**
Travels over 500 ft. on one winding. Choice of three colour schemes. Dimensions: Length 16½ in. Beam 3½ in.



HORNBY CABIN CRUISER No. 5. "VIKING."
Price **16/6**
Travels over 500 ft. on one winding. Choice of three colour schemes. Dimensions: Length 16½ in. Beam 3½ in.

HORNBY RACIN
Travels over 300
Cream



HORNBY WATER TOY (DUCK).
Travels over 100 ft. on one winding
colours. Dimensions: Length

Your dealer will be pleased to show y the range of Hornby Speed Boats and Raci Boats. Once you have seen these wonder boats you will not be satisfied until you ha one of your own.

Each model is available in a pleasing colo combination that gives it an exceedin attractive appearance.

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bought. Exceptional performance, graceful ndid boats. They introduce a new standard ie of them.

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and craftsmanship as the famous Hornby range and see for yourself how perfect

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HORNBY RACING BOATS

Hornby Racing Boats are superb! Compare these swift, powerful models with real racing craft. You will see they have the same design, the same slim, smooth lines.

The series of Hornby Racing Boats is composed of three exceptionally fine models. Each boat is extremely "quick off the mark," maintaining a high rate of speed throughout the whole length of its run.

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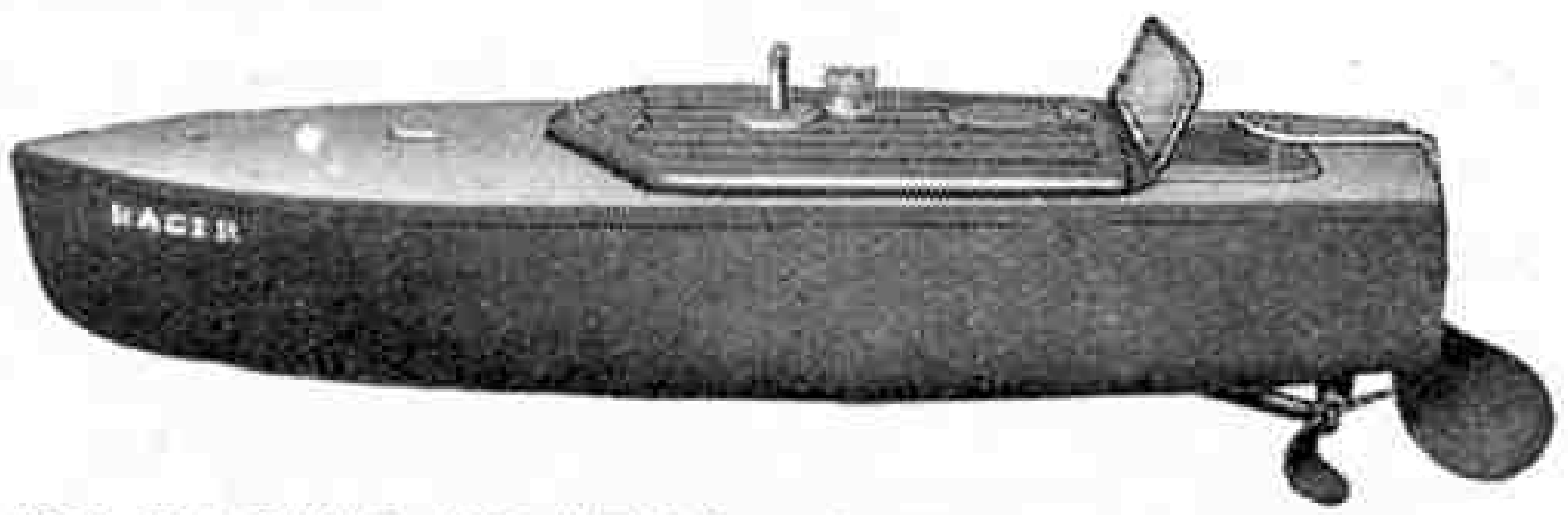
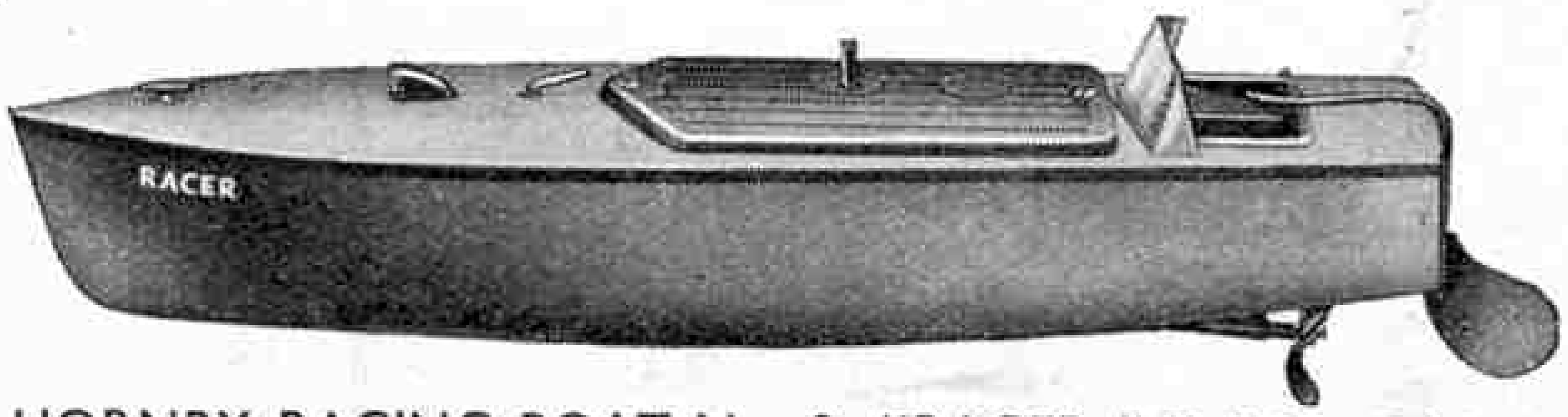
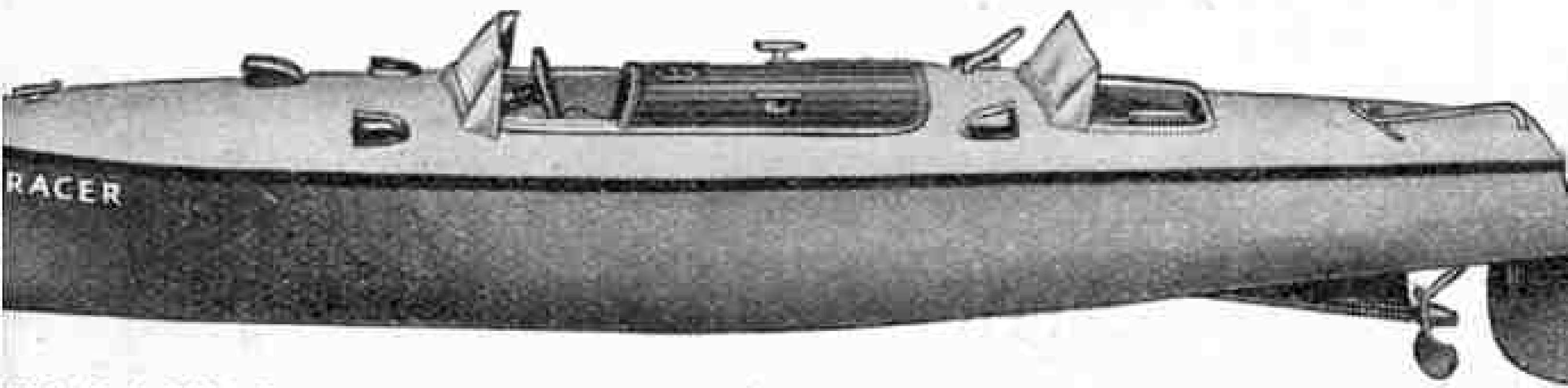


HORNBY RACING BOAT No. 1. "RACER I." Price **4/6**
Travels over 120 ft. at high speed on one winding. Finished in Cream and Green. Dimensions: Length 8½ in. Beam 2⅜ in.



HORNBY RACING BOAT No. 2. "RACER II." Price **8/6**
Travels over 200 ft. at high speed on one winding. Finished in Blue and Cream. Dimensions: Length 12½ in. Beam 3 in.



BY RACING BOAT No. 3. "RACER III." Price **14/6**
over 300 ft. at high speed on one winding. Finished in Red and Cream. Dimensions: Length 16½ in. Beam 3½ in.

(DUCK). Price **2/6**
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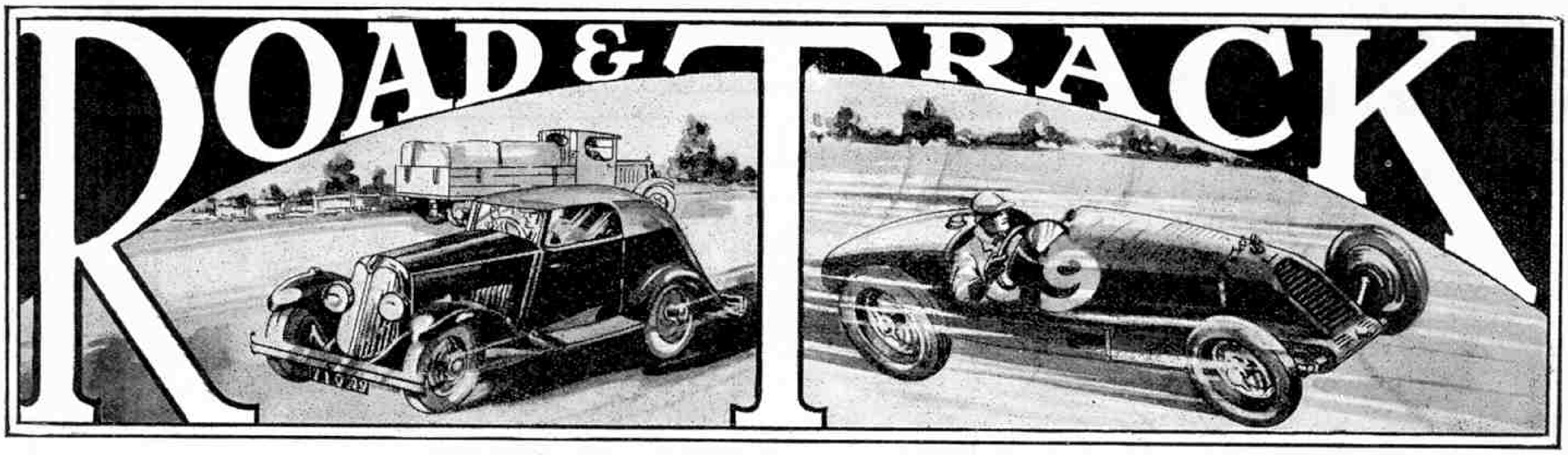
ROAD ... LIVERPOOL 13

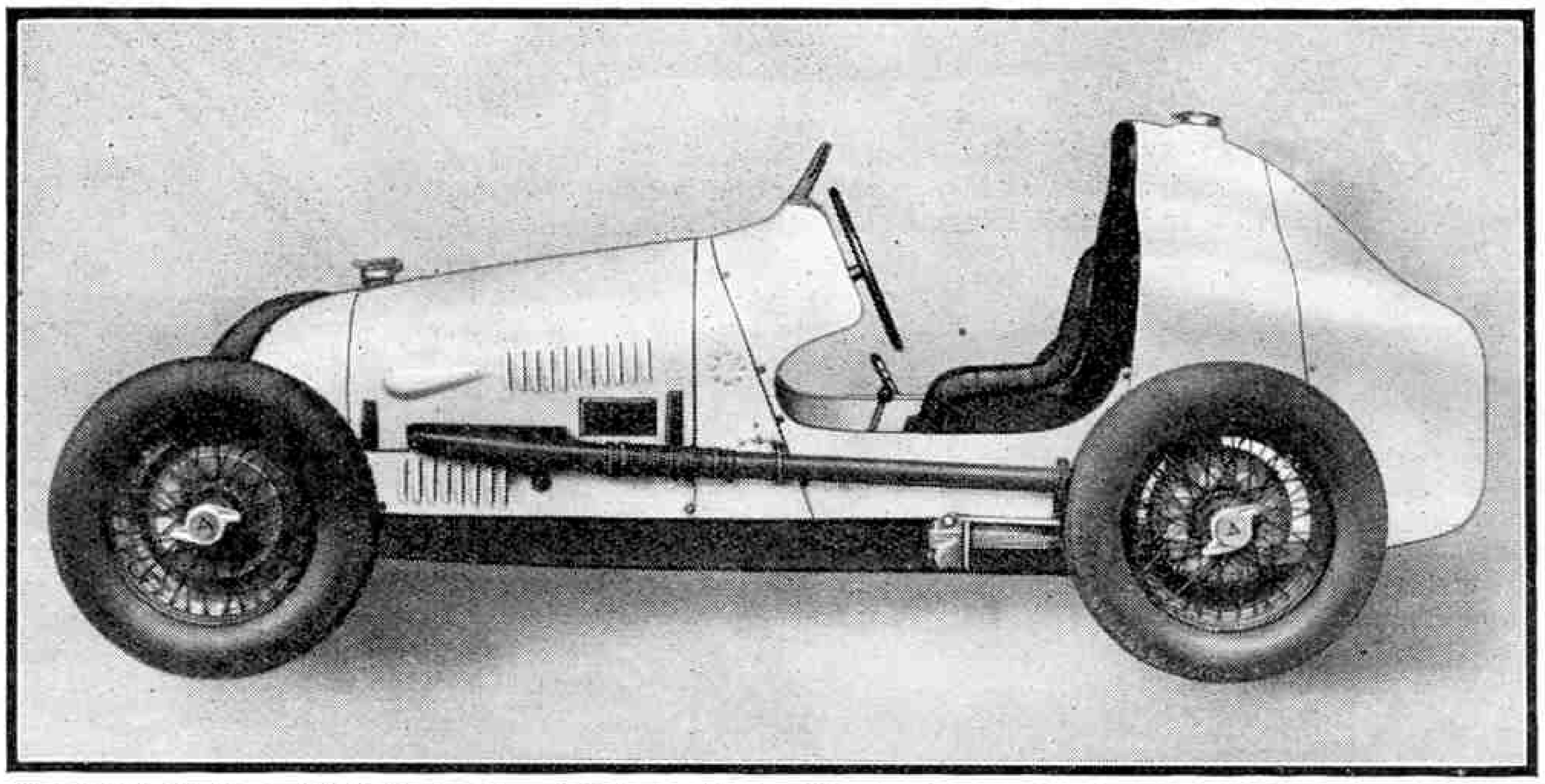
ROAD & TRACK



The New Austin Seven Racer

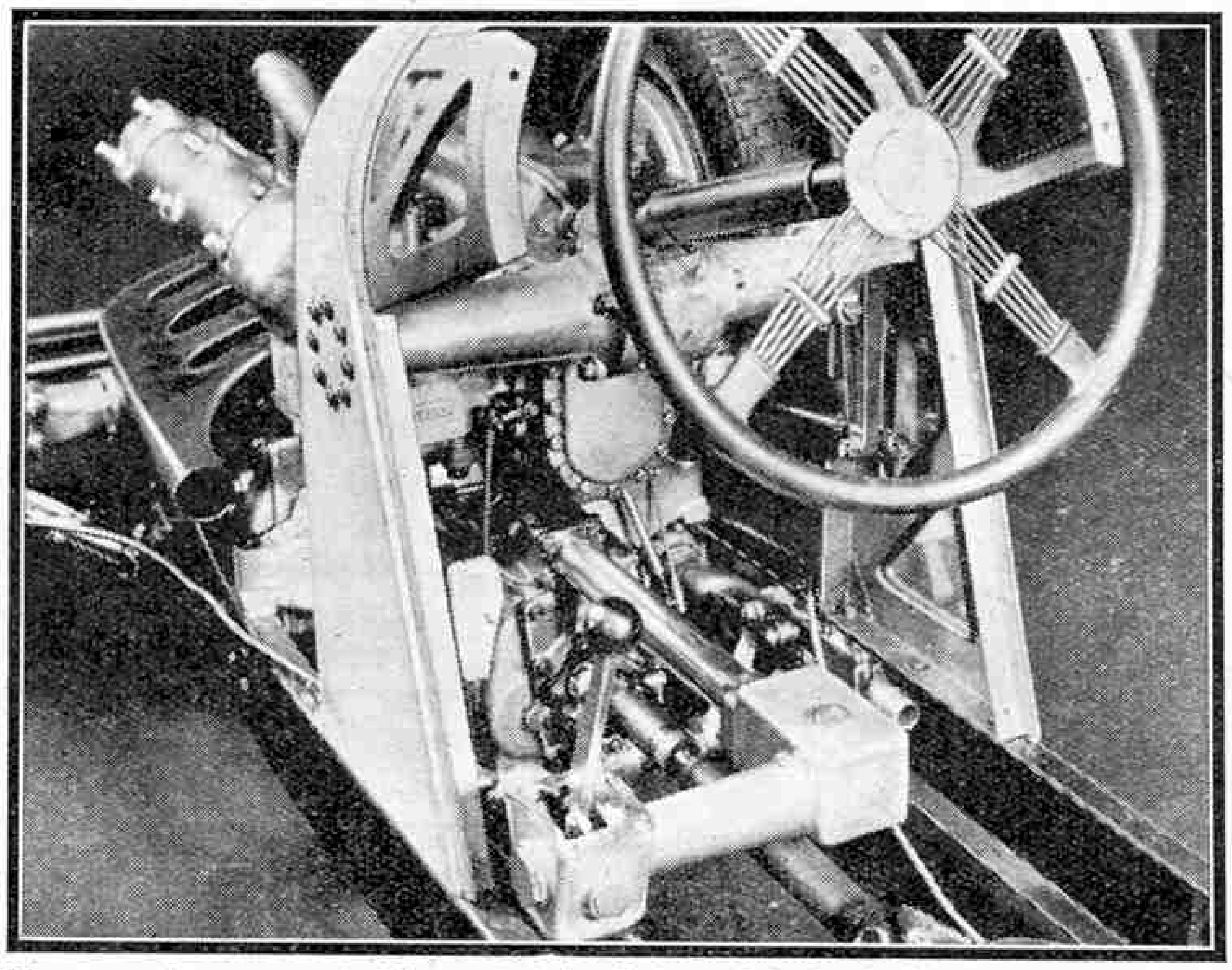
The remarkable new miniature racing car designed and built by the Austin Motor Co. Ltd. is illustrated on this page. It is known as the O.H.V. Austin Special Racer, and probably will take part in all the leading racing events of the season.

The new machine is the first Austin Seven to have an engine with overhead valves. The weight of the car is little more than two-thirds that of the standard Austin Seven saloon, but its 744 c.c. engine develops nine times as much power as that of the road car.



The new Austin Seven O.H.V. Racing Car, which is described on this page. The machine is expected to figure prominently in this season's racing events. For the illustrations on this page we are indebted to The Austin Motor Co. Ltd.

The Austin Seven made its first appearance as a racing car in 1923 and in that year won first place in the 750 c.c. class in the Italian Grand Prix at Monza. By 1924 it had captured 22 International Class H records at Brooklands and Montlhery, and in the following years it achieved many victories in road events, including the 500 Mile Race at Brooklands in 1929, the Ulster T.T. in 1930 and the International Trophy at Brooklands in 1933. It has a splendid record and the new racer should fully maintain the reputation made by its predecessor.



The compact arrangement of the controls is a feature of the Austin O.H.V. racing machine.

The engine of the new car is supercharged and separate camshafts operate the inlet and exhaust valves. The drive is transmitted through a clutch of the single dry-plate type and a four-speed gear box with remote manual control. The oiling system of a racing engine is of the greatest importance, for continuous running at high speed makes great demands on the power unit. Three separate oil pumps are used in the new Austin Seven. One delivers oil to the forward end of the crankshaft, the big ends and the roller races at the end of the crankshaft. The second delivers oil at lower pressure to the hollow camshafts and the overhead gear, and the third picks up oil as it drains to the bottom of the crankcase and delivers it to the tank, thus keeping the crankcase dry.

Thrills and Collisions at Monte Carlo

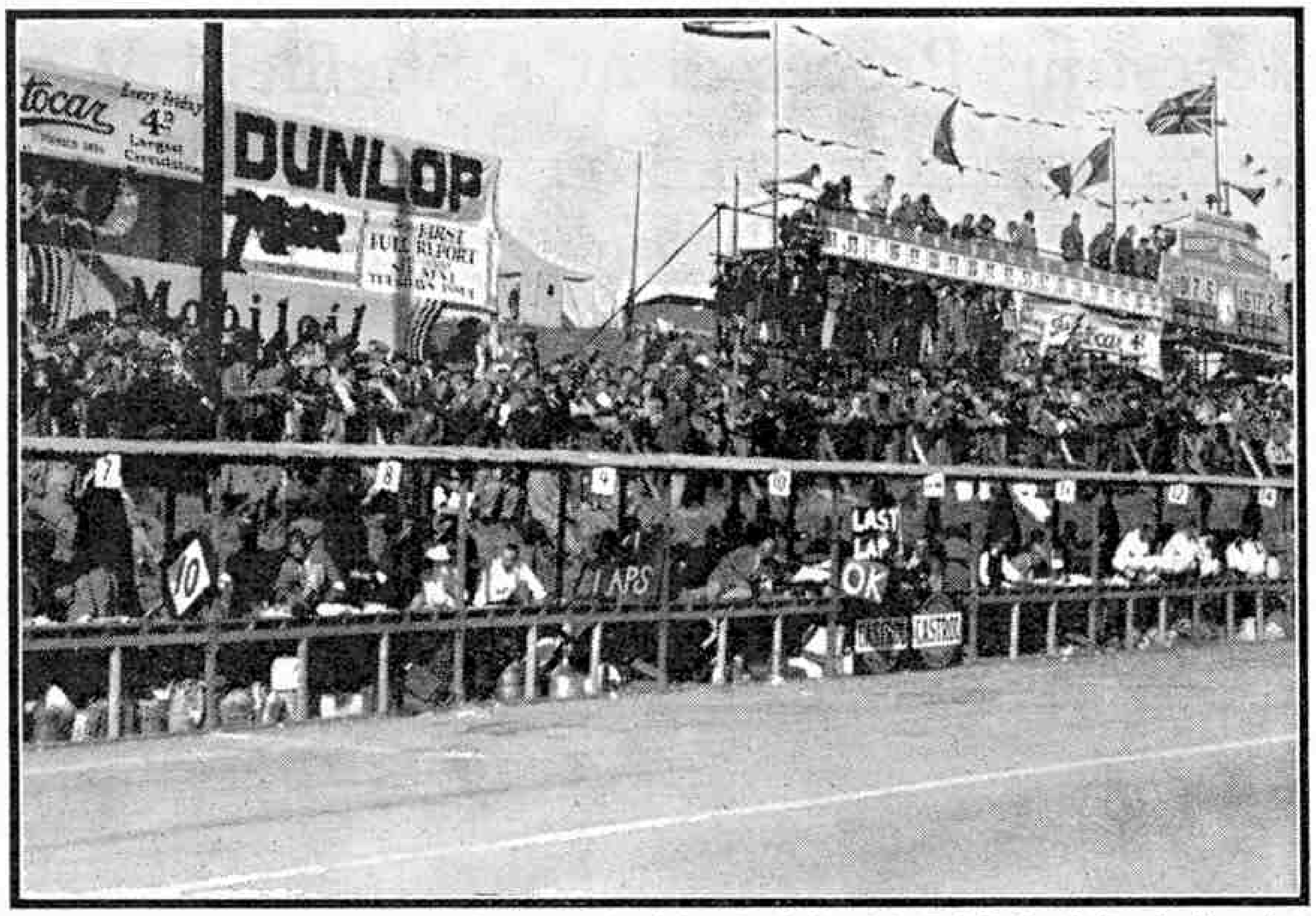
Continental racing events usually are packed full of thrills and this year's race through the streets of Monte Carlo for the Monaco Grand Prix was one of the most exciting events that have been witnessed for some time. This "round-the-houses" race is the principal event of its kind in the world. This year it was preceded by a race for 1,500 c.c. cars, in which the British team of E.R.A. cars scored a remarkable success by securing first, second and third places. The driver of the winning car was the Siamese Prince who races under the name of B. Bira. His average speed was 52.99 m.p.h.

There were 17 entries in the Grand Prix itself, but one of them, an Alfa Romeo, had gone barely a dozen yards when an oil pipe broke, and a broad stream of oil was left behind on the road. This accident proved most unfortunate for the Mercedes entrants following close behind. One of these machines, driven by the famous driver Chiron, ran straight into the stream of oil, skidded and crashed. It was followed by another big Mercedes that failed to avoid the wrecked car and also came to grief, and other cars turned right round and only narrowly escaped disaster.

Altogether it was a bad day for the Mercedes machines, for shortly afterwards one of the two cars of this make remaining in the race skidded into the wall almost alongside the wrecked car of Chiron! Only one Mercedes was then left in the race. This was a big silver-coloured car driven by Caracciola, and as though to make up for the misfortune that had befallen his colleagues, this driver succeeded in staving off all his rivals, winning the race with an average speed of 51.69 m.p.h. after a thrilling duel with an Auto-Union machine driven by Varzi, who obtained second place. Another Auto-Union, driven by Rosemeyer, skidded and crashed through the barricades.

Excitement in the "Pits"

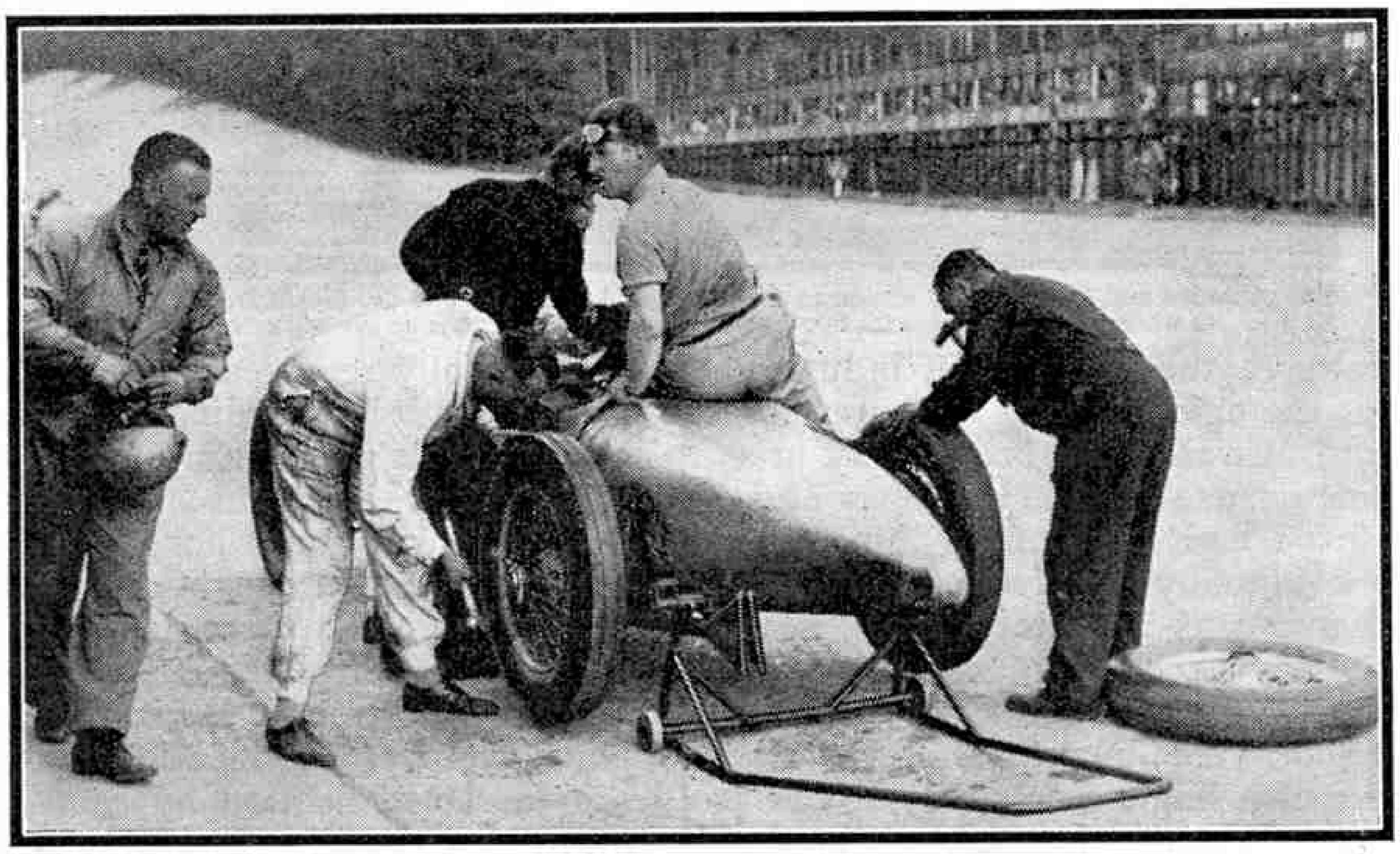
Now that the big events of the motor racing season are approaching, "pit" staffs are in for a busy and exciting time, for strategy and tactics play an important part in long-distance racing. From the start to the finish of a race the members of the pit staffs have really strenuous times. In addition to their work in refuelling the machines in their teams, changing wheels and carrying out any minor repairs or adjustments necessary during the race, they have to keep records of the laps accomplished by each competing car, and the order in which they pass the pits. This information enables charts to be plotted that show at a glance exactly how the drivers of their teams stand in the race at any particular moment.



A scene at the "pits" on the Ards Circuit, Belfast, just before the finish of the R.A.C. Tourist Trophy Race last year. The race was won by a Riley driven by F. W. Dixon, whose pit is No. 10. The illustrations on this page are reproduced by courtesy of "The Riley Record."

If one of the machines of any team is leading by a big margin, the driver may be given a signal from his pit directing him to slow down a little and so save his car from unnecessary strain and the possibility of trouble. In other circumstances a driver may be spurred on to greater efforts by means of flag signals telling him to drive his machine all out in order to keep ahead of a threatening rival, or to overtake the leader if at all possible. An example of a signal of this kind is given in the upper illustration on this page, which shows the pits on the Ards Circuit, Belfast, during last year's R.A.C. Tourist Trophy Race. The pit numbered 7, on the left, is that of E. R. Hall and a board with the sign "No. 10" is ready to be shown to him as he flashes past to tell him that No. 10 in the race, F. W. Dixon's Riley, is the only car ahead of him and to urge him to try to catch the leader, who eventually became the winner.

The scene in a pit during a race is a thrilling one. The noise is tremendous as competitors who have made calls for refuelling or repairs race their engines at top speed in getting away again. Other cars come in with a screech of brakes and squealing tyres, some with their radiators boiling, others perhaps with their engines mis-firing on some of their cylinders. Wheels and tyres are changed, minor adjustments are made, and tanks are refilled. Precise instructions and careful drill enable this to be done with amazing speed, and a double-wheel change and refuelling have often been completed in just over 30 seconds. All the while stop watches click and chart keepers work feverishly, cars streak past with a noise like thunder, and the signalman stands by with his flags, ready to give his driver any warning that may be necessary as he flashes by.



A pit staff at work changing the tyres of one of the Rileys entered by F. W. Dixon in the 500 miles race of the British Racing Drivers' Club at Brooklands in September 1935. The car was handled by Cyril Paul, seen on the left, and C. Brackenbury, who is sitting on the tail.

Motoring Under the Alps

If plans that the Swiss Federal Railway Authorities are now considering are carried out it will soon be possible to motor under the Alps between Switzerland and Italy through the Simplon Railway Tunnel. This tunnel consists of separate bores for up and down traffic and the scheme concerns the conversion of one of the bores into a motor road. If it is adopted it will be necessary to instal a complicated ventilating system to dispel the fumes of the petrol used by cars, and to construct "sidings" in the walls of the tunnel into which cars that break down during the passage can be towed out of the way of the main traffic stream.

The Simplon Tunnel links Switzerland and Italy and was built in 1906. It is over 12 miles in length and is the longest of the tunnels through the Alps.

This Month's Motor Races

Some of the chief events of the motoring season will be decided during June, and so far as this country is concerned one of the most interesting is the Shelsley Walsh Hill Climb on the 6th of the month. The hill chosen for the climb has a gradient of 1 in 6, sharp corners, and tricky bends, and the event never fails to provide spectators with plenty of thrills.

This year's climb will be made particularly attractive by the presence of Hans Stuck, the famous German driver, who is entering a new fast Auto-Union machine that has been specially fitted out for hill-climbing work. This year also the timing will be carried out electrically. The timing instrument will be set in operation automatically when the starting signal is given, and it will be stopped when the front wheels of a car operate a contact on the finishing line.

The chief events on the Continent will be the Le Mans 24-hour Endurance Race, to be run on 13th and 14th June, and the French Grand Prix, the most famous of all Grand Prix events, on the 28th of the month. There is nothing really comparable with the Le Mans Race from a spectacular point of view, for the circuit over which it is run is wide and fast and permits very high average speeds to be attained. The track consists of specially maintained main roads running through woods, and is 8.38 miles in length. The event is limited to 60 entries, and Britain will be strongly represented by Austin, M.G., Singer, Ford, Talbot and Frazer Nash cars. Last year the race was won by J. Hindmarsh and L. Fontes, driving a Lagonda, who covered 1,867.3 miles in the allotted time, at an average speed of 77.8 m.p.h.

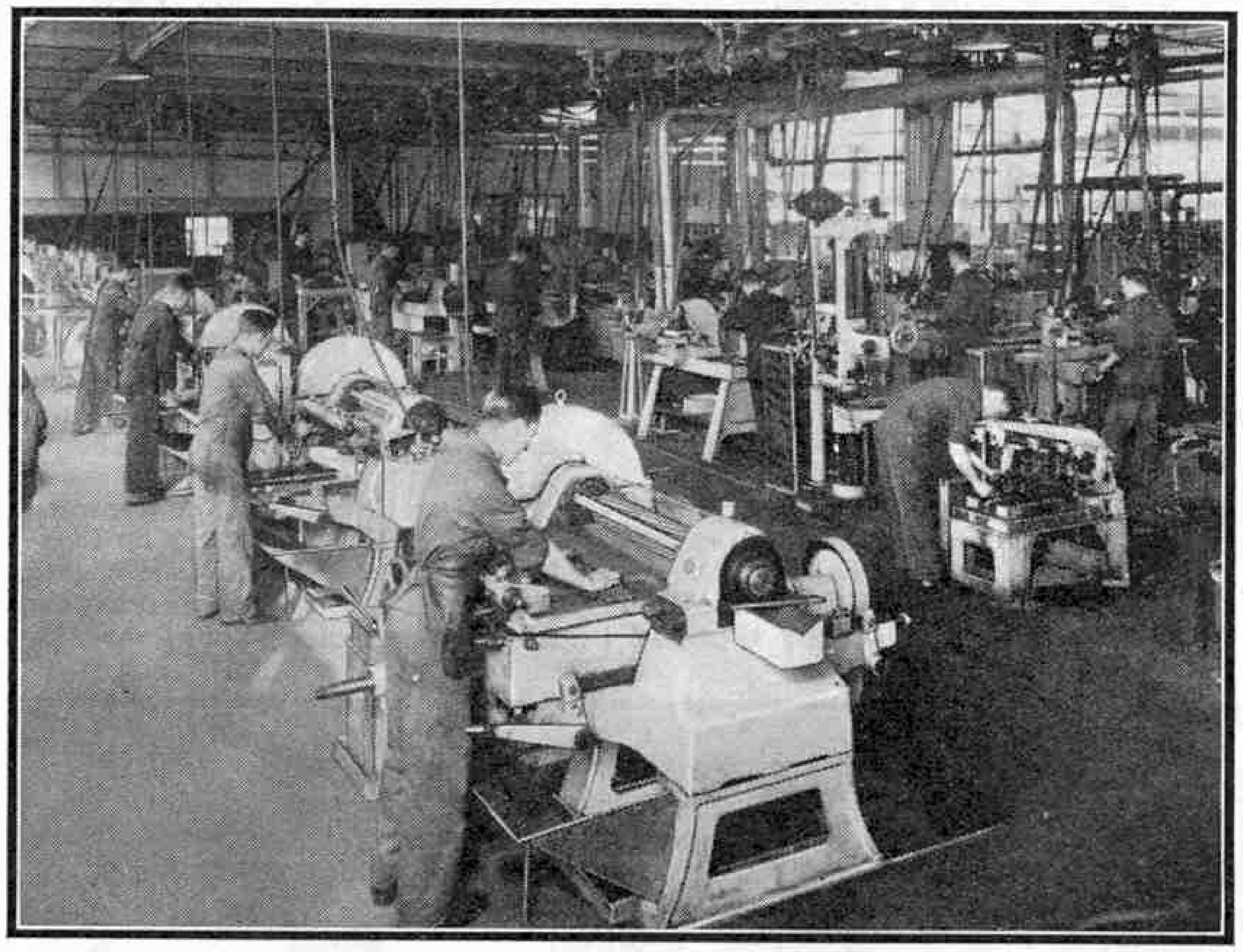
The course over which the French Grand Prix will be run at Montlhery on 28th June is a combination of track and road circuit made up of 1½ miles of artificially banked track, on which very high speeds have been attained, and a road section 7½ miles in length with long straight stretches of which are perfectly straight. The record speed for the track section of the circuit is 147.79 m.p.h. and that for the road portion 91.35 m.p.h.

This year the race is to be confined to sports cars that are not fitted with superchargers. In the past supercharged Italian and German entries have swept the board. Cars from England, America, Germany and Italy are making a formidable challenge and it will be interesting to see whether France can regain her national pride by winning the event.

Hack-Saw Blades in the Making

Interesting Processes at a Sheffield Works

IN articles that have appeared in past issues of the "*M.M.*" we have described processes entailed in the manufacture of various familiar commodities. This month we continue the series with a description of the many interesting operations involved in the making of engineers' hack-saw blades at the Sheffield steel works of James Neill and Company (Sheffield) Ltd., who are one of the largest firms of blade makers in this country. The original works was established about half-a-century ago for the manufacture of crucible steel, of which composite steel was the chief product. This material has a very hard face with a soft backing, and is widely used for making certain types of press tools, machine knives and cutters. These works also produce safety razor blades, permanent magnets and hack-saw frames. In this article, however, we are dealing only with the manufacture of hack-saw blades, and as these are made from crucible steel, a full description of their production must commence with the processes entailed in making this material. The material is melted in clay crucibles, the manufacture of which is one of the few surviving handicrafts in the engineering industry. In making the crucibles the operator uses his bare feet, and walks backward and forward on a bed of clay in a series of uniform movements, as shown in the lower illustration on the opposite page. Readers may think this process very slow, but actually it gives results unobtainable by any other means and its purpose is to expel any air contained in the clay.


The guillotine and tooth milling section at the works of James Neill and Co. (Sheffield) Ltd., Sheffield, to whom we are indebted for this illustration and the lower one on the opposite page.

When sufficiently mixed by treading, the clay is kneaded by hand for a short time, quantities of material sufficient for the making of a single crucible being dealt with separately. The kneaded mass is then put in the mould of a press, and a plunger is forced into it pressing the clay into the shape of a crucible. The formed crucible is then lifted out of the mould and a top taper is given to it by means of a hollow cone, which is pressed down on the material by hand. The crucibles are then stored on shelves for a preliminary drying, and great care is taken to keep the rate of drying approximately constant by controlling the temperature of the room by means of sliding louvres. The drying operation is completed in the steel foundry itself, the crucibles being first stored in racks above the furnaces and finally on the tops of the furnaces themselves. The crucible lids are similarly dried.

The furnaces are heated by producer gas, and the charge for the crucibles is prepared under the control of the works laboratory. Valuable constituents of the material, such as tungsten and chromium, are stored in a strong room, and are sent to the foundry in sealed packets, which are placed intact in the crucible. A charge takes about 3½ hours to melt, the correct temperature for "teeming" or pouring being ascertained by means of an optical pyrometer. The ingot moulds are of cast iron made in halves, which are clamped together, and the ingots are of rectangular cross-section and for making hack-saw blades weigh about 120 lb. each. After teeming the ingots are allowed to cool very slowly and are then marked for identification.

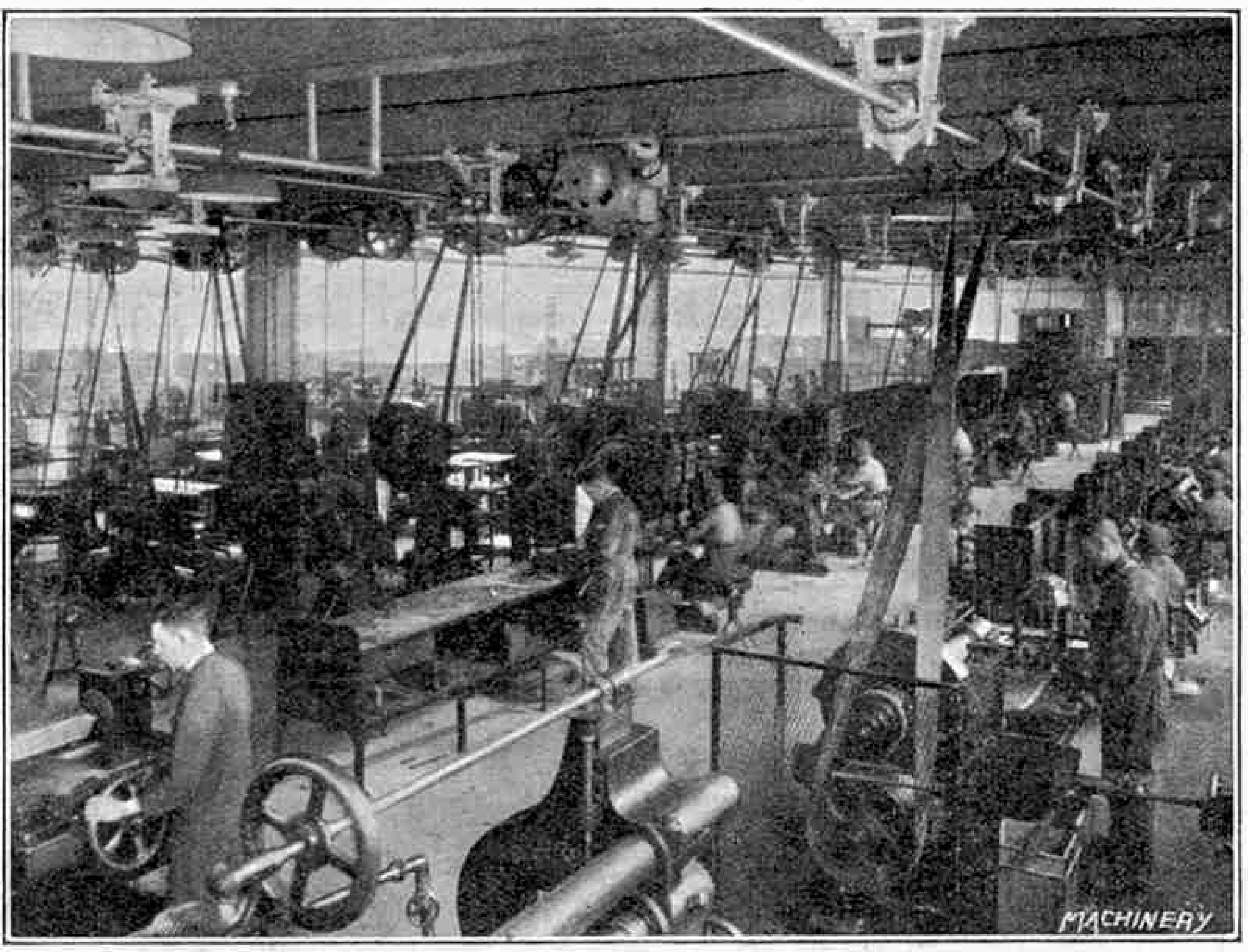
The works laboratory now again takes charge. The numbered ingots in the warehouse are drilled at each end, and the combined drillings are then analysed. As the particular characteristics of the material depends on the amount of carbon it contains the results of the analysis are carefully recorded and classified, and the ingots are rigidly graded according to their carbon content.

The ingots are then passed on to the rolling mills and rolled into sheets about 20 in. wide by from 59 in. to 66 in. long, and in various thicknesses from 13 W.G. to 23 W.G. The grading of the ingots according to their carbon content is preserved through the rolling operation, so that sheets of one thickness only are made from ingots of the same carbon content. When the sheets are returned to the blade factory, classification by thickness automatically provides classification by carbon content, and by this means it is possible to ensure that the resultant blades, when subjected to the correct heat treatment for the particular carbon content, are of uniform hardness.

The sheets are then cut by guillotine shears into pieces known as "moulders," the width of which corresponds with the length of blade required, plus an allowance for subsequent rounding of the ends. The "moulders" are then passed through guillotines endwise and sheared into strips a little wider than the finished blade. The next operation is that of milling the teeth, and for this purpose the strips are firmly clamped into a solid mass containing about three gross of 23 W.G. strips, on the table of a milling machine of the type shown in the upper illustration in the opposite page.

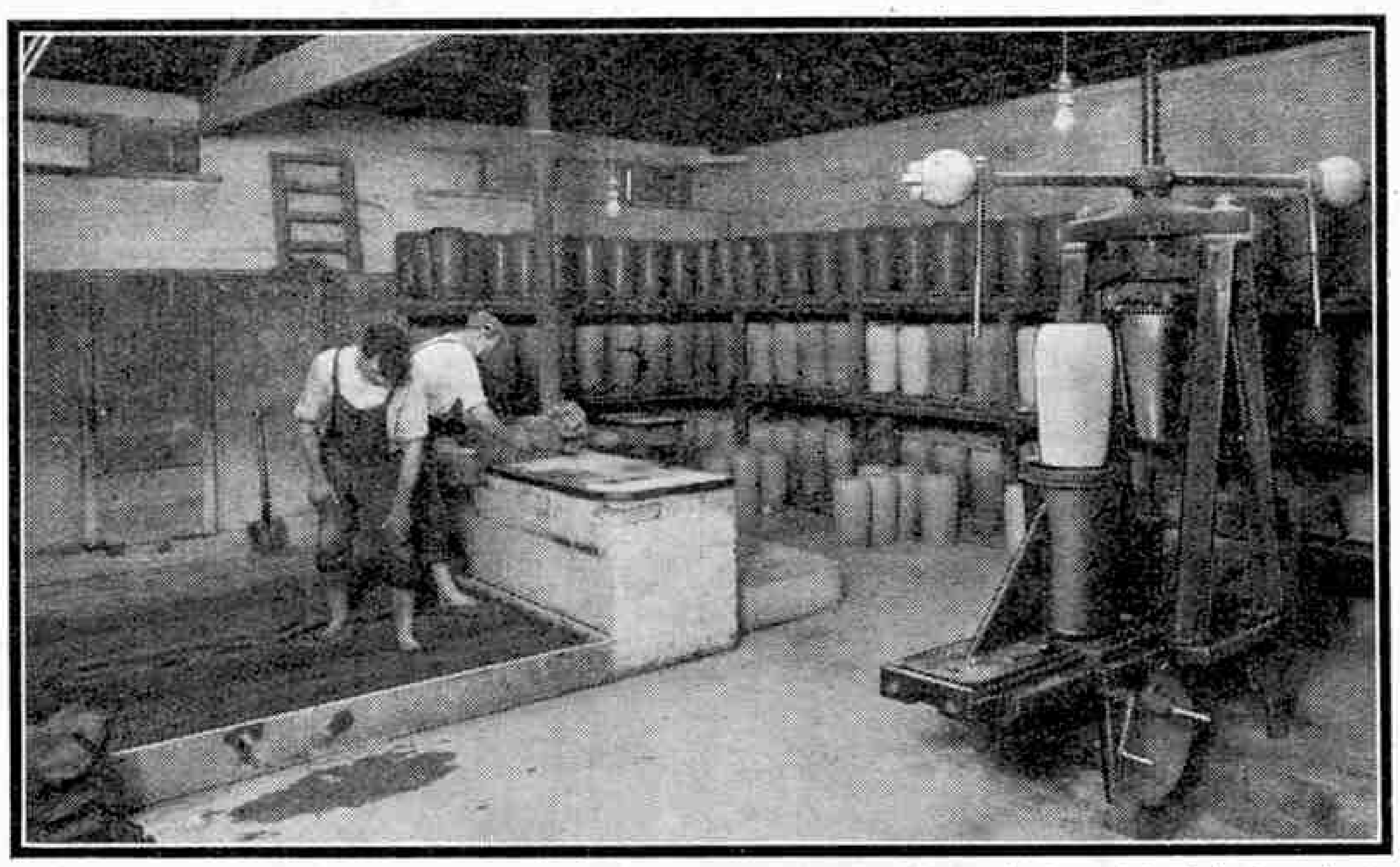
The work table is mounted on inclined ways on the saddle so that the height of the surface of the block of blades may be adjusted relative to the cutters. The cutters are of what is known as the gang type, that is, each individual cutter is set with its teeth slightly behind those of the adjacent one, the resultant cutting edge being of helical form.

The setting of the teeth to ensure that each tooth has sufficient clearance to do its own share of the work is done on automatic machines made by the firm, the feeding of the blade being arranged to synchronise with the form of the setting rollers, so as to prevent "splitting" of the teeth in the process. The machines allow of any variation in thickness and width.


A view in the tooth setting and hack-saw blade finishing section of the machine shop at the works of James Neill and Co. Ltd., showing on the right part of the tooth cutting plant. For this illustration we are indebted to the courtesy of "Machinery."

After setting, the strips pass through heavy power presses, one stroke of which performs three operations simultaneously, i.e., the rounding of both ends, the punching of a hole at each end, and branding with the word "Eclipse," the trade name under which these blades are marketed.

The blades are now ready for heat treatment, and the exact nature of this depends upon the type of blade required. There are four different types. The all-hard blade is, as its name implies, hardened throughout its depth. Blades of this kind are usually preferred by skilled operators on account of their rigidity, but for hard work by less experienced persons, or when the work cannot be rigidly held, flexible blades are the more suitable, as they are unbreakable in use. The all-hard blades are heated in a gas-fired furnace to a temperature of about 800 deg. C, the temperature being automatically controlled by a thermostatic device. At the end of the period of treatment an electric bell signals to operators at each end of the furnace that a new batch is to be inserted and the heated one withdrawn. An adjustable time-switch enables the period of treatment to be set to suit the size of blade concerned.


A scene in the crucible department showing workmen treading beds of clay with their bare feet.

On removal from the furnace the blades are quenched in a bath of pure sperm oil, and are then removed to centrifugal separators, which remove the oil and leave the blades so dry that the scale may be shaken off by hand. The blades are then ready for tempering.

Flexible blades are hardened only in the vicinity of the teeth, and naturally undergo a different heat-treatment process. The temperature of the teeth and immediate vicinity is raised to about 800 deg. C, and the blades are then quenched in an oil well, thus effecting the hardening of the toothed edge only. The back of the blade is then left soft.

A third type of blade has teeth on both edges, and here again the hardening is confined to the toothed edges, the centre of the blade being left soft. This blade is used for small-diameter cutting, and tubes in which the blade does not pass wholly through the material cut. Both the flexible and double-edge blades are cleaned in the manner already referred to. All three types are, after cleaning, tempered by insertion in a large gas-fired furnace which is raised to the desired temperature. This furnace is provided with means for maintaining the temperature in a uniformly distributed manner. When the desired temperature has been reached the gas supply is cut off, and the furnace and the blades inside are allowed to cool without infiltration of air.

The final process consists of softening the ends of the blades in the region of the tension-holes by means of which they are fixed in the saw frame. This is done by placing them on an endless belt, by which they are carried over a series of gas jets.

During the process of manufacture the blades are inspected and tested in various ways. After setting, for example, a careful check is made to see that the amount of set is correct. The blade is inserted in a gauge having three slots, the first of which checks the thickness of the back of the blade, in the second slot the set teeth must not enter, and in the third slot the teeth must enter. This ensures that the set of the teeth is between limits of the width of the second and third slots. A number of blades selected daily at random are examined on a hardness-testing machine. In the warehouse, before bundling the blades, a final examination takes place, and they are then oiled by being passed through rollers covered with oil-soaked material, bundled into dozens and packed.

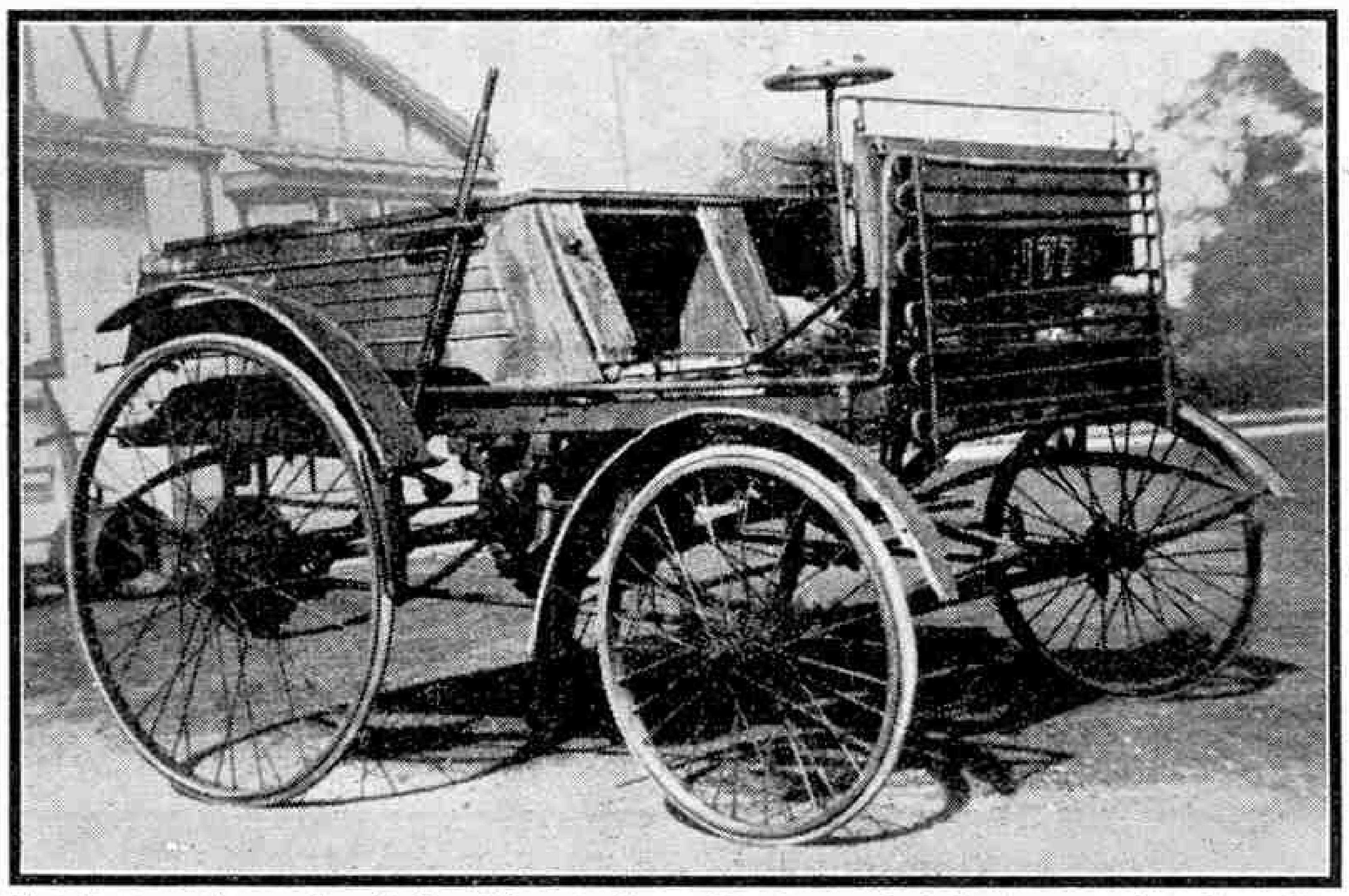
As a final check of the quality blades taken from each day's production are submitted to actual cutting tests.

FROM OUR READERS

These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for these pages are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

A Pioneer Motor Car

I saw the old car shown in the photograph on this page at a garage near Worcester. I strolled over to have a look at it and the garage proprietor told me some of its history. It was built at Malvern and put on the road in 1889. Several types of power unit were tried out in it. The first was a steam engine, and afterwards it was made to run on ordinary coal gas, benzoline, and finally petrol. It had no rubber tyres, no springs and no upholstery, and at first the driver had to hire a man to walk in front waving a red flag. Its speed then was about 4 m.p.h., but later, when this restriction was removed, it achieved the much higher speed of 12 m.p.h.



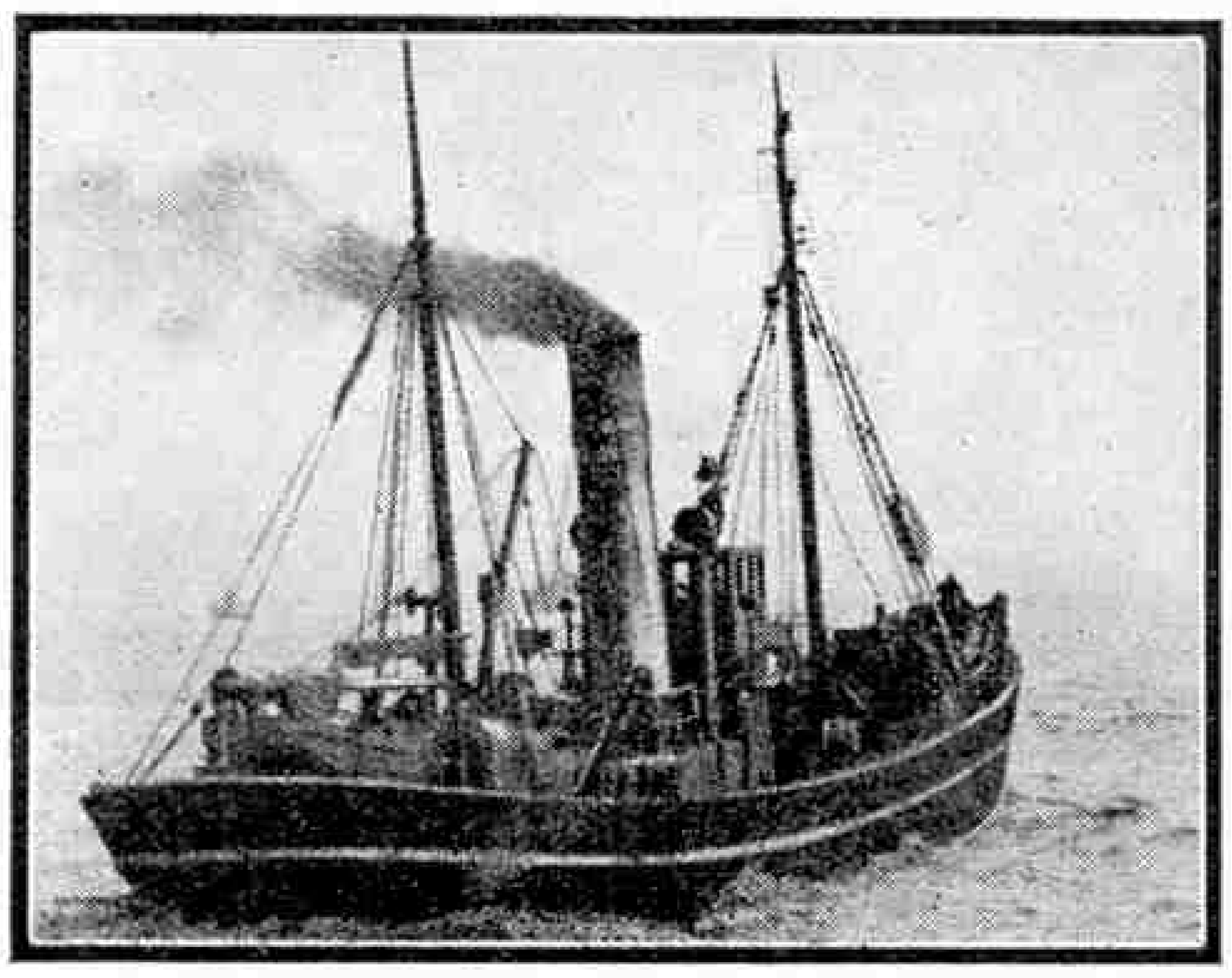
The pioneer motor car described on this page. It was driven successively by steam, coal gas, benzoline and petrol. Photograph by R. Green, Birmingham.

The "joys" of motoring in this ancient car must have been very few, for its occupants rode on it and not in it, and had no protection from the weather. The steering wheel stands straight up, and the driver had to crouch forward over it in an attitude very different from that of the driver of to-day. The radiator resembles a huge gridiron, and the whole appearance of the vehicle is so strange that it is difficult to think of the motor car of to-day as its direct descendant.

R. GREEN (Birmingham).

A Trip to the Faröe Islands

Recently I visited the Faröe Islands fishing grounds in a trawler. We left St. Andrew's Dock, Hull, and steamed down the Humber, waving a greeting to the crew of the Bull Lightship as we passed on our way to the sea. After rounding Spurn Head, with its lonely lighthouse, we turned northward and by evening had picked up the flashing light of the lighthouse on Flamborough Head to the north of Bridlington Bay.



A Hull trawler on the way to the Faröe fishing grounds. Photograph by J. W. Casson, Hull.

Our course followed the east coast of Great Britain and twice on our way northward we were out of sight of land, once when cutting straight across the Firth of Forth, and the second time when crossing Moray Firth. Then we entered the Pentland Firth, and in this narrow strait, through which the Atlantic tide races furiously, we found ourselves in very choppy water. Off Dunnet Head we headed straight for the Faröes, on our way passing the rocky Skerries with their warning light.

Early one morning I was thrilled to see rushing through the grey dawn the low dark form of a swift cruiser. I was told that this was a Danish fisheries protection vessel, employed to prevent illegal fishing within the three mile limit. This limit does not follow each curve of the coastline, as I had hitherto supposed. Instead two points at a convenient distance apart are selected, and an imaginary line is drawn to connect them. The limit then is a parallel line three miles out at sea.

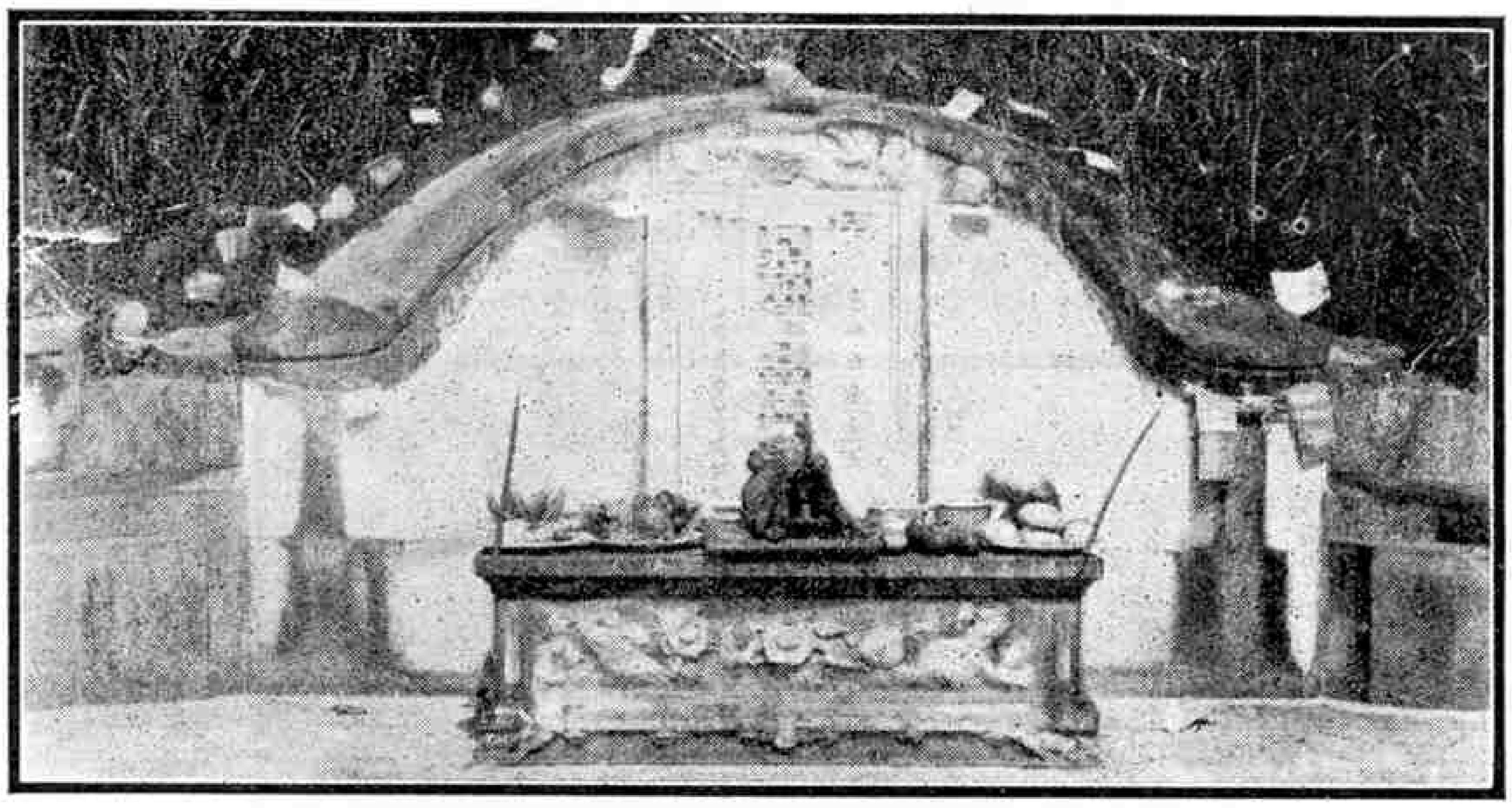
I was fortunate to see the Faröe Islands themselves, for these are often enveloped in fog. My greatest thrill came one day when I was on the bridge and the sky darkened, the wind began to blow hard, and the waves rose higher and higher. Lightning played vividly across the dark expanse of sea and cloud, and soon the waves began to sweep right over the bridge itself. I held on grimly, as the vessel dived into the troughs between the waves and then rose to mount the crests, on which she seemed to pause for a moment before plunging downward again with a shiver. For three hours no one could get to the bridge or leave it owing to the violence of the seas breaking over the trawler.

As we passed Dunnet Head again on our homeward voyage the skipper mounted the roof of the bridge and flagged a message to the lighthouse keepers. The news he gave was to be forwarded to the owners of the trawler by telephone. J. W. CASSON (Hull).

A Quaint Chinese Custom

The Chinese are noted for their devotion to their ancestors, and the custom known as the Cheng Beng Festival, or the Feast of Tombs, is still observed by Chinese all over the world.

Once a year, on the 13th day of the Third Moon, corresponding to the English month of April, the Chinese visit the graves of their ancestors, and offerings of a large roasted pig, two or three small pots of boiled rice, the staple food of the East, tea, cakes and fruits are placed on stone tablets in front of the graves for the dead to feast upon.



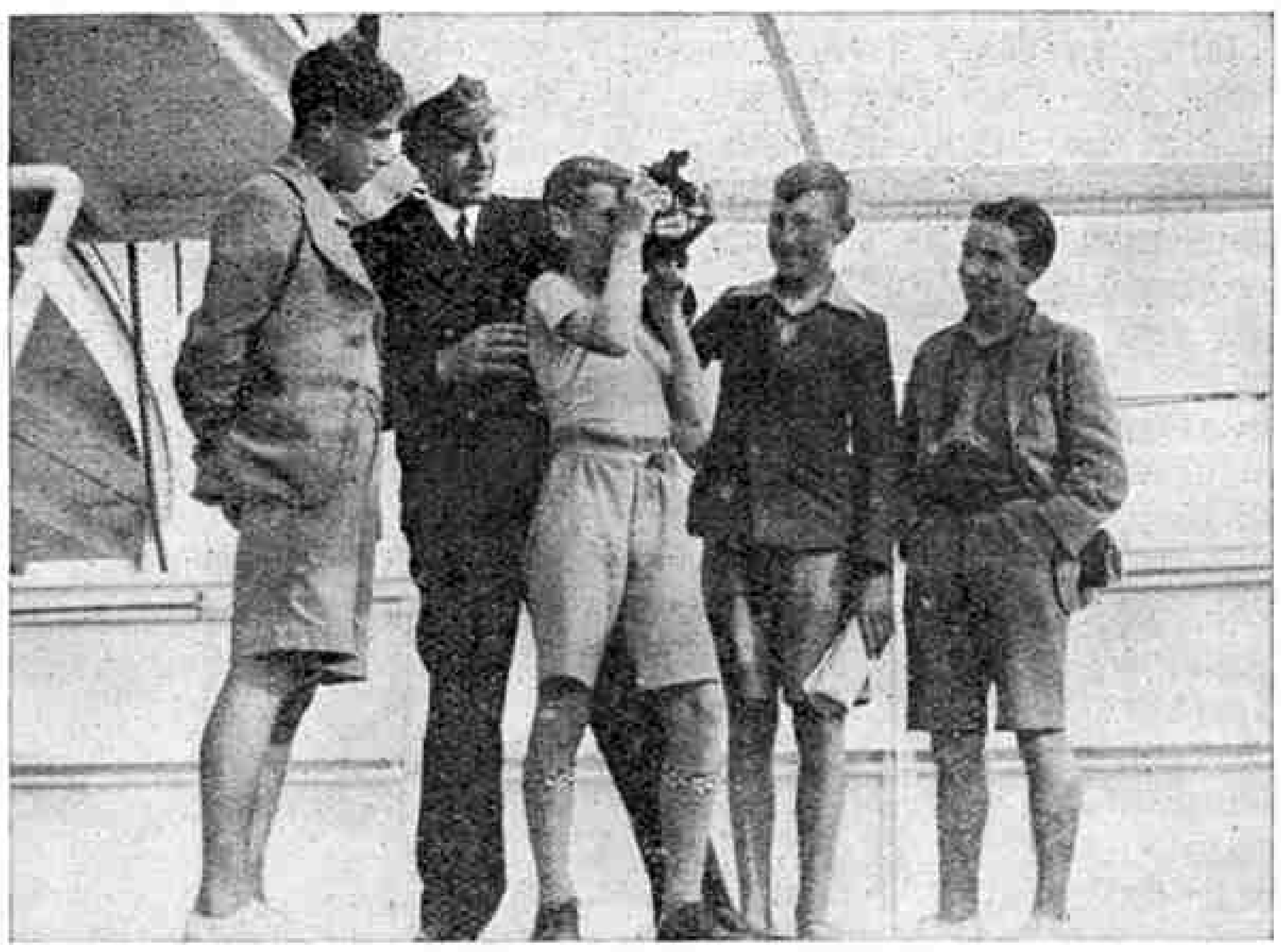
Offerings on the altar before a Chinese grave, over which can be seen the silver paper money referred to in the accompanying article. Photograph by Lim Kean Chuan, Penang.

When the dead have had their fill, which is decided by the toss of two coins, small square pieces of paper are burnt to serve as money for the dead in the next world. Other pieces of silver paper of the same shape are then scattered over the grave to conclude the ceremony.

The accompanying photograph shows a Chinese grave with the offerings upon the altar, and the pieces of paper-money scattered all over the grave also can be seen. LIM KEAN CHUAN (Penang).

Cruising in the Baltic Sea

During the summer of last year I enjoyed a fortnight's cruise to the northern capitals of Europe. I was one of a party of about 700 schoolboys and our home during the trip was the "*Neuralia*." We left Tilbury on a baking hot day but met a refreshing breeze as we steamed down the Thames Estuary towards the open sea. Late in the afternoon of the third day we arrived at Arendal, a picturesque Norwegian town at the end of a small fjord surrounded by frowning coniferous trees. We landed amid the curious stares of the greater part of the populace, but fog in the North Sea had made us late and we only stayed two hours before steaming southward through the Kattegat to Copenhagen. There a civic reception awaited us, and when the formalities had been completed we proceeded on a motor coach tour of this delightful city. I was impressed by the number of cyclists in its streets; in Copenhagen even the business man goes to the office on his machine.



"Shooting the Sun" during a cruise in the Baltic Sea. Illustration by courtesy of the Secondary Schools Travel Trust.

Two days afterwards found us approaching Stockholm by a long island-studded inlet of the Atlantic Sea. Stockholm is a beautiful city with a wonderful new Town Hall and many fine shopping centres, where we had no difficulty in making purchases, as English is freely spoken.

After a happy stay of two days in Stockholm, we passed on to Helsinki, the capital of Finland, which is known as the "White City of the North" because it is built of white granite and is free from smoke. Drizzling rain that fell all the time we were there did not damp our spirits as we went ashore by tender, and in the evening we had tea in the Municipal Gardens as the guests of the authorities.

Next day we left Helsinki for the long trip to Kiel, and spent two lazy days playing deck games or splashing in the small swimming bath. When we awoke on the third morning, the "*Neuralia*" was anchored in Kiel Harbour, with battleships, submarines and Herr Hitler's state yacht forming a background to the scene. On going ashore we were greeted in a very friendly manner.

Next day we passed through the canal into the North Sea and on our way home passed the "*Bremen*," travelling at great speed and throwing up a wash that tossed even our 9,000-ton ship about. The following day we spent in gathering our scattered belongings, and in the evening we enjoyed a deck concert and sing-song. As the white cliffs of England appeared through the dusk a strange hush fell upon us, to be broken by thunderous cheers for Old England.

C. SHAW (Millwall).

The Wild Cattle of Chillingham

I was never really afraid of bulls before I saw the wild cattle of Chillingham in Northumberland, but I was frightened even of the calves of that herd! The cattle are white, shaggy animals of great ferocity that have roamed the Cheviots for 700 years, but now are confined to a hill on Lord Tankerville's estate at Chillingham. They are ruled by a King Bull, who in the Spring has to struggle hard to retain his supremacy, for all the bulls then fight each other until one emerges as the conqueror. Those who are beaten slink away into the hills and are not allowed near the herd again.

When I went to see these creatures the keeper told me that not long before he had been chased by them and forced to climb a tree until they went away. Visitors are not allowed to approach nearer than 50 yards from them, but can look at the herd through field glasses. C. CLARKE (Berwick-on-Tweed).

Meccano Suggestions Section

Edited by "Spanner"

(352)—Electrically Operated Radial Engine

(M. Andrews, Salford)

Some time ago we described a four-cylinder car engine operated by solenoids and also a small single-cylinder engine driven in the same way. In each of these models the solenoids were built up from Bobbins, part No. 181, wound with thin copper wire. Owing to the interest that these models created we think that the engine illustrated on this page will be of interest to many Meccano model builders. This new model represents a five-cylinder radial, air-cooled engine, and it is built up from Elektron Magnet Coils and Cores. Considering the somewhat unorthodox method of operation, the model is surprisingly powerful and efficient, and is quite suitable for incorporating in a model aeroplane of suitable scale size. It works at a speed of about 200 r.p.m., but it is advisable to run it at about 120 r.p.m. This will be found to be quite fast enough for ordinary use.

The building of the engine is commenced by bending a 7½″ and a 2″ Strip into a circle 3. To these Strips are secured five 1½″×½″ Double Angle Strips, and these carry at their free ends a series of 1½″ Strips. The 1½″ Strips are arranged in the form of five triangles, the apex of each pointing outward. At each apex two Flat Brackets are bolted in place. The opposite ends of the 1½″×½″ Double Angle Strips carry a similar arrangement of 1½″ Strips and Flat Brackets, but in addition ½″ Reversed Angle Brackets 11 are fitted.

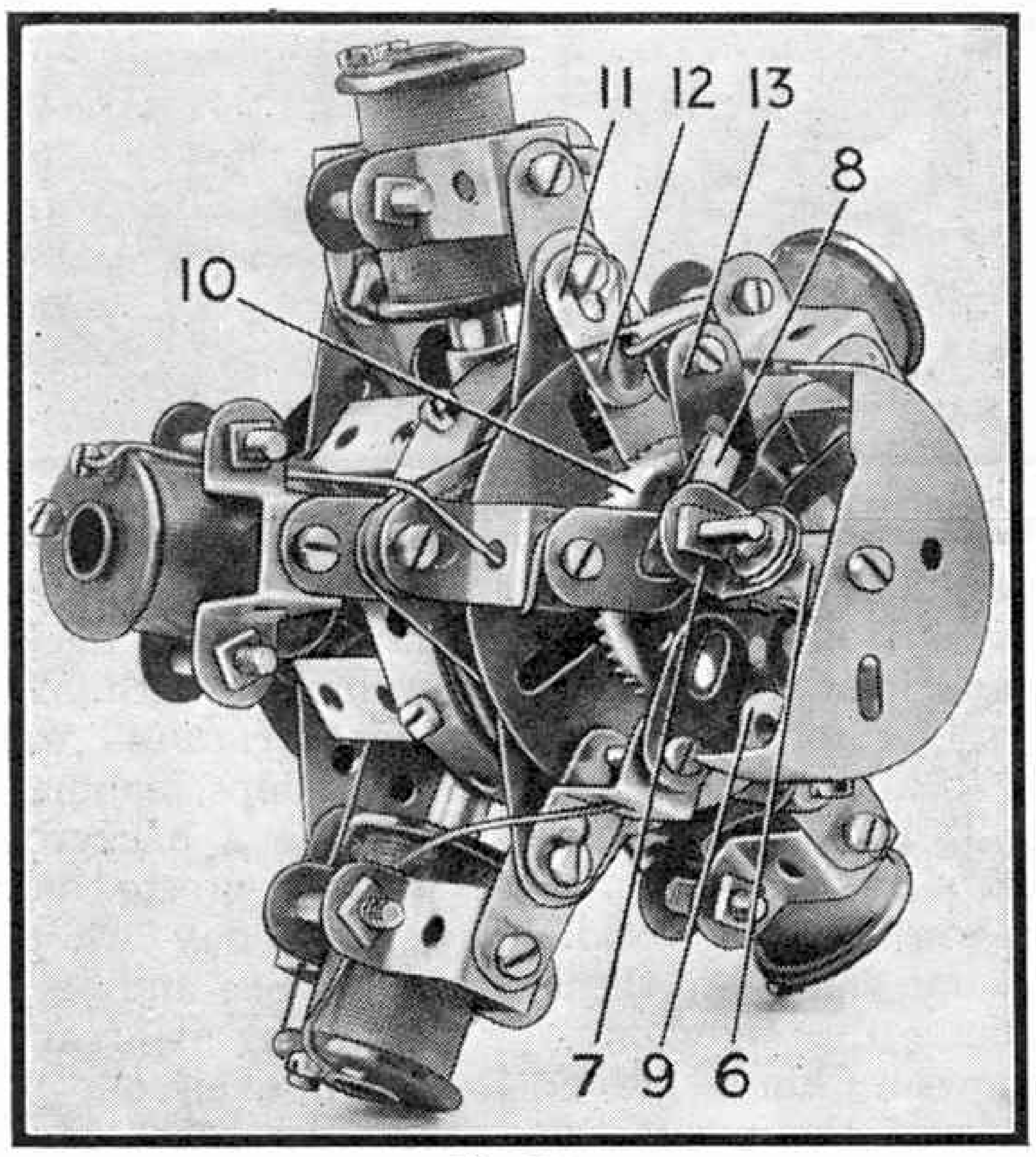


Fig. 352.

The Flat Brackets 12 and the corresponding Flat Brackets at the other side of the engine serve to clamp in place two Face Plates both of which are shown in Fig. 352. The Face Plate, only partly shown in this illustration, should not be fitted until the crankshaft and connecting-rods are put into position.

The Magnet Coils should now be fitted, and this part of the construction is carried out in the following way. Each of the Flat Brackets secured to the top of each pair of 1½″ Strips forms a support for a Double Bent Strip, and each pair of these latter parts are clamped together by ¾″ Bolts. The Magnet Coils are held between the Double Bent Strips and are clamped in place by the ¾″ Bolts. A Core is now inserted in each Magnet Coil and on the threaded portion of this is clamped a Collar by means of a grub-screw. As a further security the 6 B.A. Nut, supplied with the Core is screwed on to the threaded shank and tightened against the Collar. The unoccupied threaded hole of the Collar carries a Bolt on which is pivotally mounted a 1½″ Strip.

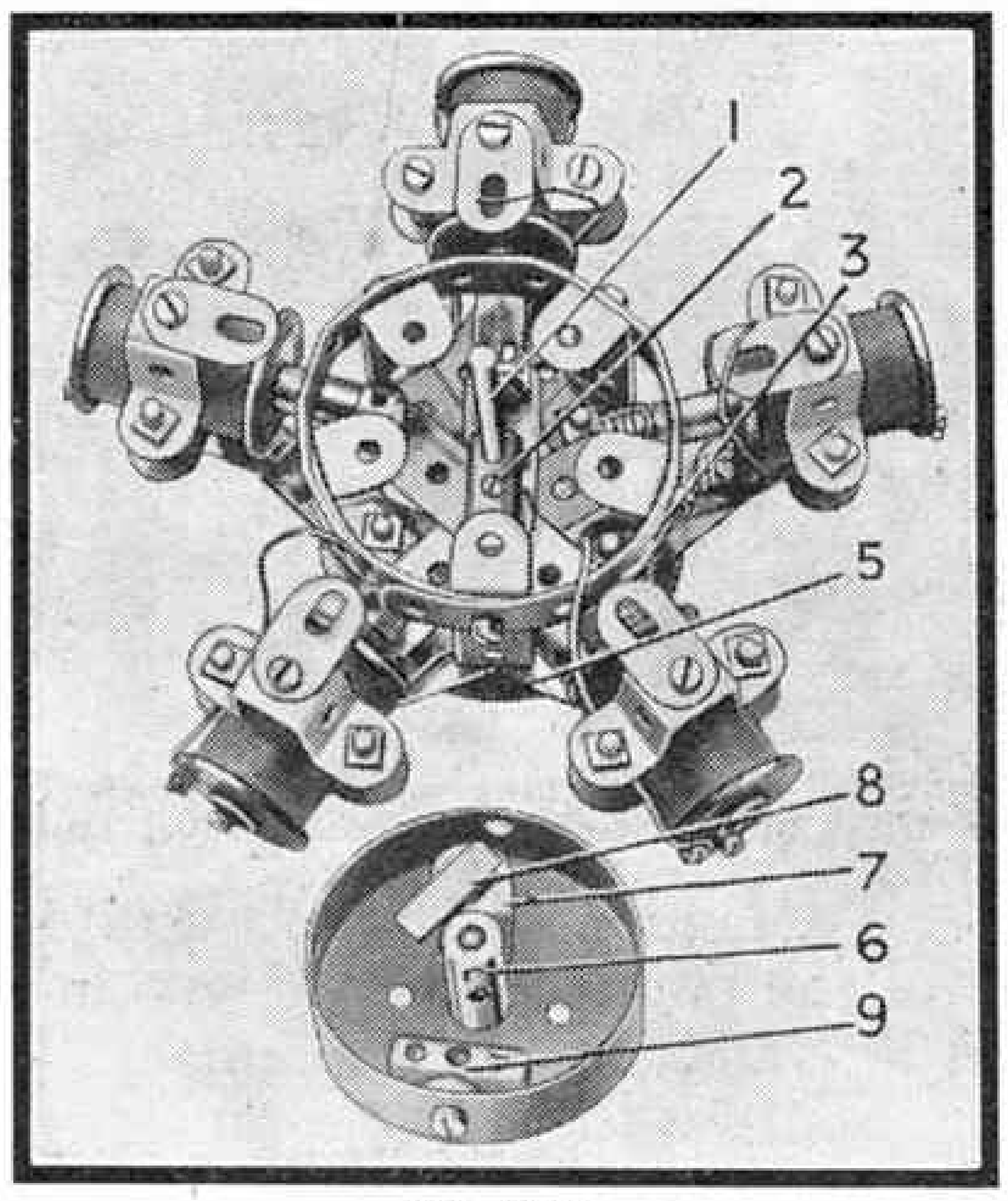


Fig. 352a.

The free ends of the five 1½″ Strips, when they are all fitted in position, are carried on a 1″ Screwed Rod that is fitted at each end into the centre tapped hole of a Coupling. Two grub-screws, one of which is shown at 2, Fig. 352a, are screwed in tightly to hold the 1″ Rod in position. These two Couplings and the 1″ Threaded Rod together form the crankshaft and this complete unit is supported on two short rods, one of which is shown at 1. The inner ends of these rods are secured in the plain holes at one end of each Coupling, and they are journalled in the bosses of the Face Plates already mentioned. Two Washers are carried on the 1″ Threaded Rod on each side of the 1½″ Strips and they serve to keep these Strips from rubbing against the Couplings. Two more Washers are used on the short rod opposite to 1, in order to give sufficient clearance between the Face Plate, shown fitted in Fig. 352a, and the crankshaft. A Collar is fitted on the outer portion of this Rod and bears lightly against the boss of this last-mentioned Face Plate.

Great care must now be taken in lining up all the 1½″ Strips forming the connecting rods and also the Cores forming the piston rods. When this has been accomplished to the builder's satisfaction the Face Plate, not shown in the lower illustration, is fitted, and this forms the bearing for the Rod 1. This Face Plate is clamped in place by the Flat Brackets 12 in the manner already described. The Rod 1 also carries a 1½″ Contrate Wheel 10 that forms a small flywheel.

The ½″ Reversed Angle Brackets 11 each carry a Flat Bracket 13, and this is secured in place by a 6 B.A. Bolt and Nut and also an Insulating Bush and Washer. These Flat Brackets form the segments of a stationary commutator, and the brush is caused to rotate with the crankshaft and make contact with these. The brush is formed by bending a Pendulum Connection 8 as shown in the lower illustration, and securing it by a 6 B.A. Bolt and Nut to an Angle Bracket 7. This latter part is bolted to a Threaded Coupling 6, and three Washers are used for spacing purposes.

The Threaded Coupling is locked on the outer end of the Rod 1 by a grub-screw, and it must be so arranged that the brush 8 makes contact with each Flat Bracket 13 at exactly the right moment. Thus when one Core is ready to enter its respective Magnet Coil, the brush should make contact with the Flat Bracket opposite that Coil. The outer end of the Coupling 6 is threaded and it accommodates a Bolt that is used to clamp in place a Boiler End. In Fig. 352 this Boiler End is shown cut away in order to make the internal construction clear. At a point on the Boiler End opposite to the webs of the crankshaft a Coupling 9 is fitted and this forms a counterbalance weight.

It is a simple matter to connect the Magnet Coils. Each inside terminal of the coils is connected to opposite Flat Brackets 13, the remaining terminals all being connected together and linked up with an insulated Terminal on the frame of the model. A second main terminal is now fitted and this must be "earthed" to the frame. It will now be seen that the current flows through the frame of the model along the brush 8 and in turn through each Magnet Coil.

(353)—Aeroplane Modifications

(A. Hope, Manchester)

Last month, on the "With the Model Builders" page, a suggestion for a pointed nose piece to be used in conjunction with No. O Aeroplane Constructor Sets, was described. This idea has apparently interested many builders of Aeroplane Models and we have received a variety of suggestions in connection with these. Among the many letters received was one from Mr. A. Hope, Manchester 12, who brought to our notice some modifications that he has recently carried out in connection with No. O Aeroplane Constructor models.

Although in some cases new parts have been added to models and slight alterations made to existing parts, his work is nevertheless worthy of highest merit. His model Hawker "Osprey" Seaplane Fighter is very realistic. The Interplane Struts and Wing Struts have been slightly altered and the lower wing foreshortened. These rather drastic alterations are more than justified by the final appearance.

(354)—Balance and Lever Movement (A. Munja, Calcutta)

The upper illustration on this page shows a mechanism that is probably reproduced in Meccano for the first time. It is a demonstration model of a watch or spring-driven clock lever movement, and its construction is a triumph of accurate Meccano Model Building. All the parts used in this model are Meccano, except for a length of thin brass strip used for the "hair spring." The mechanism works at a much slower speed than an actual lever movement owing to the size of the balance wheel, but its beat is quite regular, and can be used to drive an actual clock.

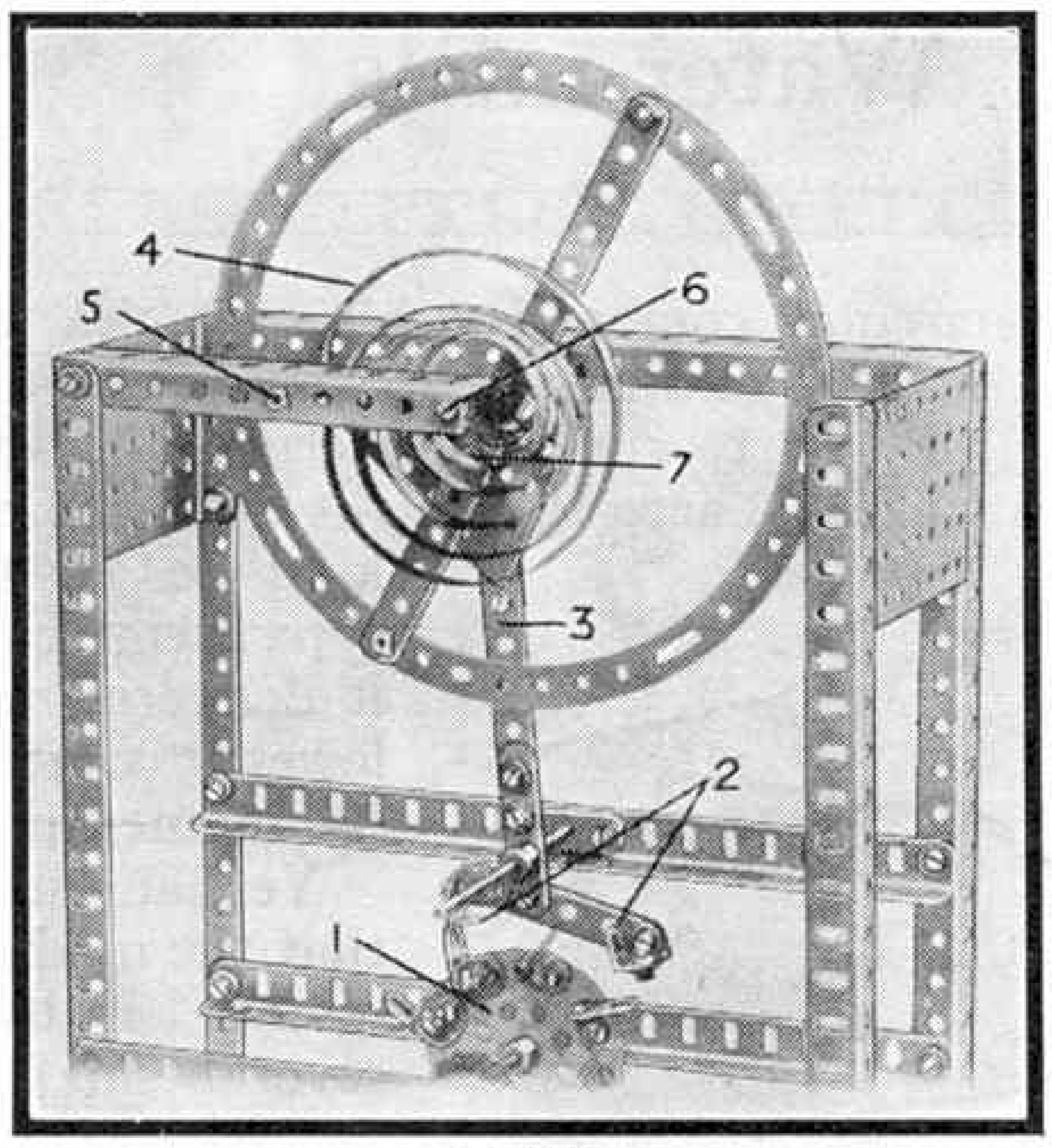


Fig. 354.

The complete mechanism is shown mounted in a frame of very simple construction and no driving unit is shown fitted. Any of the Meccano Clockwork Motors are suitable for driving this mechanism for a short period, but the best method is to employ an Electric Motor driving through an epicyclic gear.

The balance wheel is built up from two Circular Strips across which is bolted a 7½″ Strip. This carries at its centre a Double Arm Crank, the boss of which accommodates a 1″ Rod. To each end of this Rod is secured a Coupling in the outer ends of which are gripped 1″ Threaded Rods, pointed at their ends. The bearings, indicated at 6, can be formed from Grease Cups, but in this model they are specially made from bolts having a small conical depression in their ends. This depression is made with the aid of an ⅛″ diameter twist drill. These bearings must be adjusted very carefully so that the balance wheel swings as freely as possible.

The hair spring is made from a strip of brass 4 secured at its inner end to one of the Couplings carried on the balance wheel pivot. This connection is made by a bolt and two Washers. The other end of the spring is clamped in the slot of a Strip Coupling mounted on a Threaded Pin shown at 5. The spring is an 18″ length of springy brass, ⅜″ wide, and .010″ in thickness. The length of this spring must be so adjusted that when the balance wheel is in equilibrium the Threaded Pin 7 is immediately below the pivot of the balance wheel.

The Threaded Pin 7 engages with the "crutch" that is mounted on one end of the lever 3, formed from a 4½″ Strip. The crutch is built up from two 2½″ large radius Curved Strips, overlapping the Strip 3 two holes, and also two 3″ Strips. As will be seen, the Curved Strips sweep outward towards the 3″ Strips. The lever 3 is pivotally mounted on a Rod near one end, and at its lower extremity it carries a 2″ Strip and a Flat Bracket. These two parts are used in preference to a 2½″ Strip for purposes of adjustment. The pallets 2 are each built up by ½″ Angle Brackets as shown, and they must be arranged to correspond exactly with those in the photograph. The construction of the escapement wheel is shown in the illustration.

(355)—Lightning Arrestor (J. McIntyre, Invergordon)

Meccano has once again been found of use for practical purposes. Fig. 355 illustrates a neat safety switch for a wireless, designed by J. McIntyre, of Invergordon. No doubt many Meccano boys will put the model to good purpose.

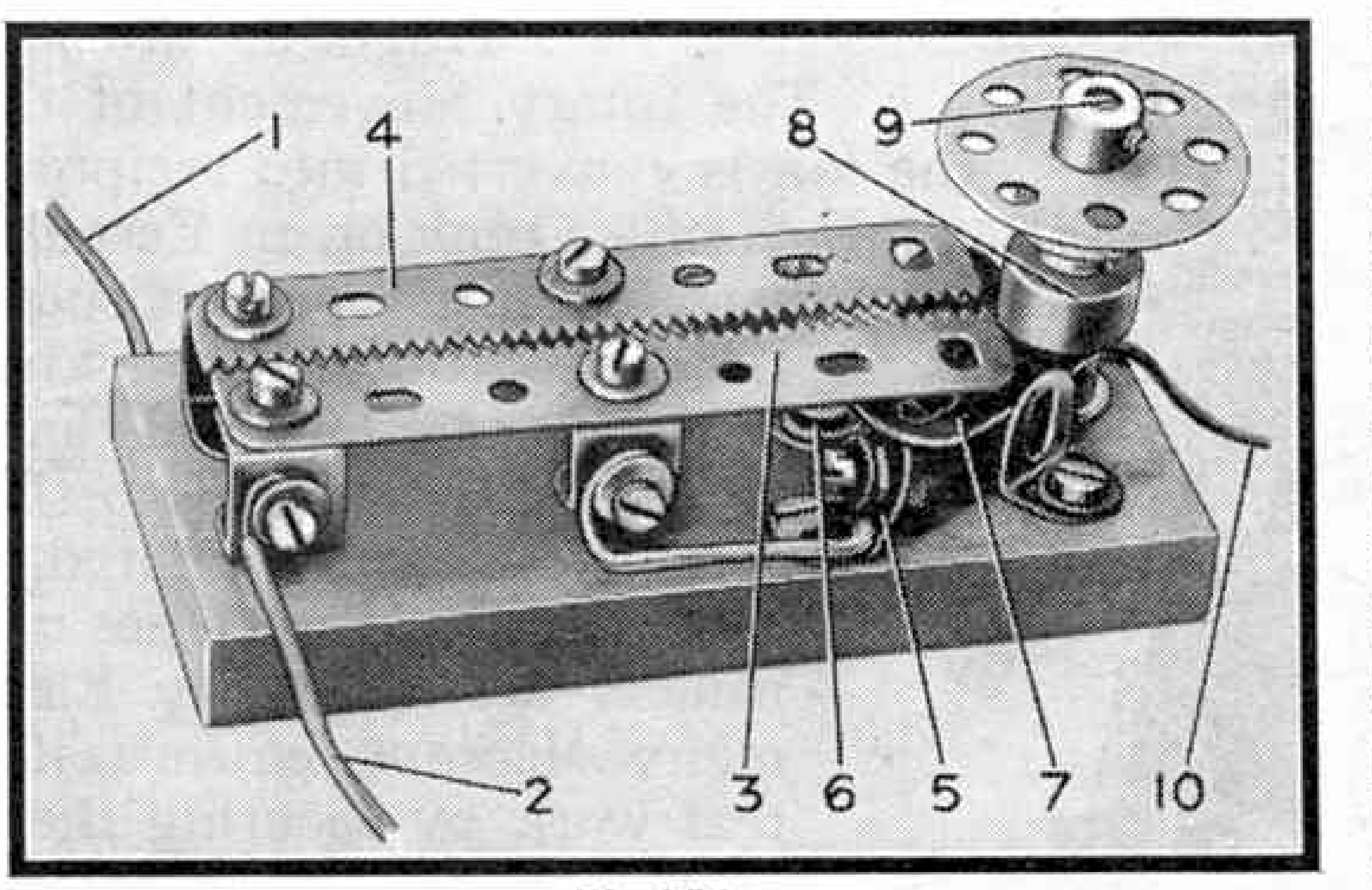


Fig. 355.

As will be seen it consists essentially of two 3½″ Rack Strips 3 and 4 mounted on a small baseboard by means of Double Brackets. One of the Double Brackets carrying the Rack Strip 3 is connected by a length of heavy gauge copper wire to an Obtuse Angle Bracket 5. A second Obtuse Angle Bracket is similarly placed on the opposite side of the base and is connected to Rack Strip 4. The wire 1 connects the Rack Strip 4 to the aerial and the wire 2 forms the earth wire. The connection from the set is made by the wire 10 to a crank 6 that carries in its boss a 2″ Rod 9. This forms the support for a Socket Coupling 8 and Crank 7 and the upper end of the Socket Coupling carries a Bush Wheel as shown.

With the Bush Wheel in the position shown in Fig. 355, the Crank 7 is in contact with the Obtuse Angle Bracket 5 and the set is earthed. When the Bush Wheel is turned to make contact with the second Obtuse Angle Bracket the set is connected to the aerial, and if this should happen to be struck by lightning, the charge leaks away to earth across the gaps between the teeth of the Rack Strips. When the set is not in use the Bush Wheel is turned so that the set is connected to earth.

This switch is best secured outside the house in such a position that the vertical aerial and earth wires can be brought close together without bending them to any great extent. This precaution adds considerably to the safety of the wireless set. The wire 10 is used to connect the switch arm 7 with the aerial terminal of the set. The earth terminal of the set must be connected in the ordinary way to "earth."

Results of Suggestion Voting Contest

This year's Suggestion Voting has again proved the popularity of gear-boxes. Electric Motors this year are also in the foreground, and much to the surprise of the judges the Counting Machine, Suggestion No. 324, received many votes. This is of course a very complicated mechanism, and one which normally would only appeal to few model-builders. The method of voting adopted was similar to that employed on previous occasions. The first four most popular models were selected by means of a system of points and the winners of the contest was found by a similar means.

The results for Home and Overseas Sections were very similar, first place being taken in both cases by the Four-speed and Reverse Gear-Box (No. 332), by a wide margin. The Counting Machine (No. 324) took second place in the Home Section, and fourth place in the Overseas Section. The third position Home and second position Overseas have been occupied by a model Synchronous Motor (No. 320), which has proved popular on other occasions. Another gear-box fills the fourth place in the Home Section and third place in the Overseas Section, this being the Three-speed and Reverse Gear-Box (No. 336).

No competitor submitted an entirely correct solution, and the system of points, to which reference has already been made, was resorted to. A maximum number of points was allotted for each suggestion placed in correct position on the competitor's list, and a reduced number of points according to the extent of the misplacement.

Home Section

The first and second prizes of cheques for £1/1/- and 10/6 respectively and other money prizes have been awarded to the following competitors. The winner J. Franklin Anderson, Hillhead, Glasgow, is to receive a cheque for £1/1/-. The second prize of 10/6 goes to B. Hardie, Bristol. Prizes of 2/6 have been sent to: L. Martin, Cheltenham; J. C. Thompson, Sutton-in-Craven, Yorks.; J. Staunton, Felixstowe; E. Wrayford, Moretonhampstead, Devon; W. Thomas, Swansea; E. Haffield, Dublin; G. Hope, Liverpool; J. Phillips, Liverpool; T. W. Green, Mapperley, Notts.; B. Dagnall, Sidcup, Kent; A. Dick, Brighton; V. Harding, Dagenham.

Overseas Section

The first prize of £1/1/- has been won by C. J. McCain, Sydney, Australia; and the second prize of 10/6 goes to Paul Cevestre, Fecamp, France. Each of the following 12 competitors receives a prize of 2/6: R. Burbery, Christchurch, N. Zealand; J. M. Brown, Cambridge, N. Zealand; F. van Bulck, Brussels; G. Sadler, Alberta, Canada; D. Murison, Buenos Aires; E. Azzopardi, Sliema, Malta; C. Keekok, Singapore; B. Walsh, Nelson, N. Zealand; J. Walker, Leichhardt, N. S. Wales; F. J. Abbott, Wellington, N.Z.; A. Carpinter, Christchurch, N.Z.; Pablo Giese, Buenos Aires.

(M170) Sprocket Wheels. The present system of Meccano Sprocket Wheels appears to have found some disfavour in the eyes of W. Bradshaw, Sheffield. In his recent letter he suggests that the present sprockets, except 18 and 36 teeth Wheels, should be replaced by wheels having 12, 24, 30, 42 and 48 teeth. With these, nineteen different ratios would be obtainable. The idea would be rather costly, however, and it is unlikely that we shall be able to carry out his suggestions for some time.

In Search of New Models

Windmills and Water-mills

WINDMILLS and water-mills are interesting structures in themselves and the construction of miniatures of them gives splendid opportunities for effective and realistic structural work, and also for the introduction of simple but interesting mechanisms. Thus they are useful subjects both for the Meccano enthusiast with a small Outfit and for the more experienced model-builder with larger resources. Windmills of course are more common in Holland than in this country, and there form a prominent feature of the landscape. It is therefore not surprising that many models of this kind have originated in Holland, and Fig. 2 on this page is an excellent example of one of these.

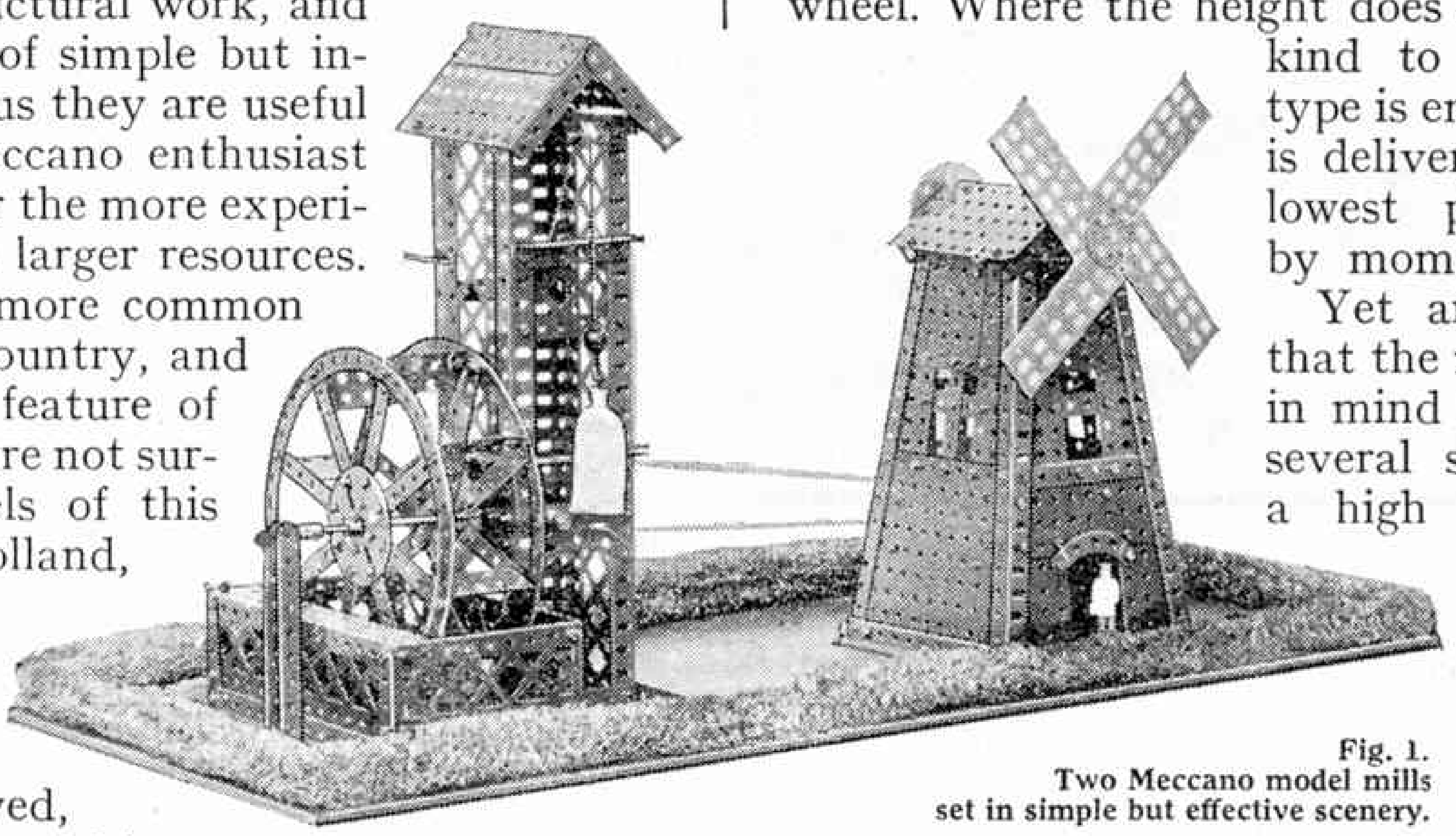


Fig. 1. Two Meccano model mills set in simple but effective scenery.

In this country many windmills are still preserved, although few are kept in working order. Model-builders who wish to reproduce their chief features may have seen some of the windmills yet remaining in existence, or may be able to obtain the details they require from photographs that have appeared in periodicals or in books on windmills. They vary in an interesting manner. In some cases they were built as towers and their four revolving sails or sweeps, as the miller calls them, were mounted on a revolving cap so that they could be turned to make the best use of the prevailing wind. The movements of the caps were controlled by fantails behind the sweeps that automatically turned them to the most favourable position. In other cases the entire windmill was mounted on a post and could be turned round for the same purpose. In the latter case a long beam that was either horizontal or sloped downward was used to turn the mill, and at its outer end was mounted on a wheel to ease the labours of the miller.

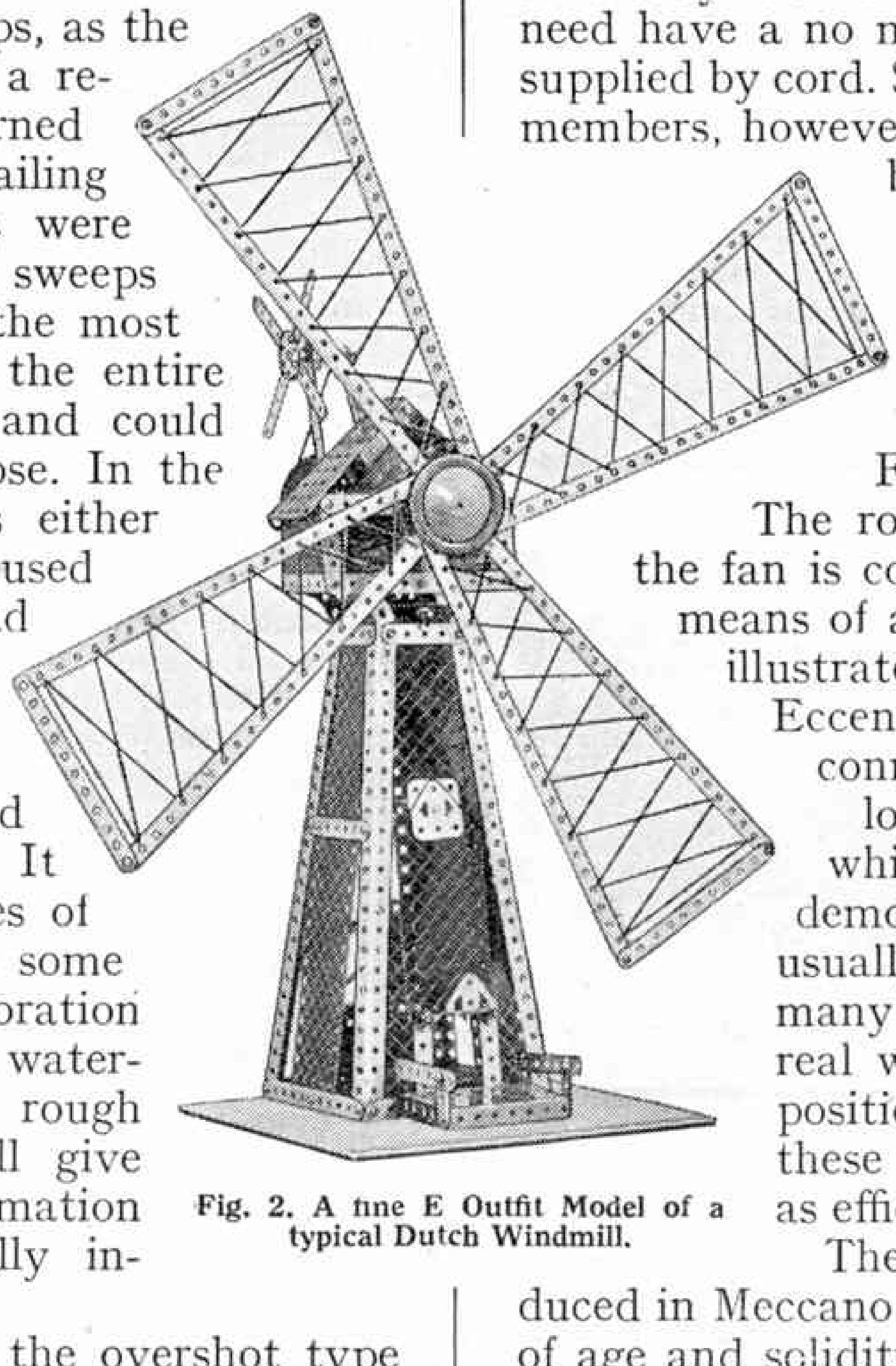


Fig. 2. A fine E Outfit Model of a typical Dutch Windmill.

Mills driven by water are still used, especially in the hillier and more remote parts of the country, It is not perhaps easy to find examples of them, as in many cases they are at some distance from roads. A little exploration often reveals a really old fashioned water-mill still working, however. A few rough sketches or a photograph then will give the model-builder all the information he requires for constructing a really interesting model.

Where possible what is known as the overshot type of wheel is employed in a water-mill. In this the floats fitted round the circumference of the wheel are arranged to form receptacles for the water, which pours into them from the mill dam as they reach the top of their circular course. In this case the water acts partly by impulse and partly by weight, and after doing its work is allowed to run into a trench or sluice underneath the wheel. Where the height does not allow a wheel of this kind to be used the undershot type is employed. In this the water is delivered to the floats at their lowest point and acts entirely by momentum.

Yet another type of windmill that the model-builder should bear in mind is the modern one, with several small vanes mounted on a high tower, usually a steel structure. Windmills of this kind are used largely for pumping water, either from wells or in drainage work. The fan is kept pointing into the wind by a specially designed fin, and it is used to drive the pump.

A model of this type of windmill is shown in Fig. 5. Others can be built in considerable variety, and very small Outfit models of this kind can be made to look extremely attractive. The main framework can be represented by four long Strips or Angle Girders, and bracing need have a no more substantial appearance than that supplied by cord. Strips can be used to advantage as cross members, however, as shown in Fig. 5. The fan is often built up from a Bush Wheel carrying radially disposed Strips twisted slightly to represent blades. The vane or fin for keeping the fan facing the wind is best represented by a Flanged Sector Plate, but in smaller models Flat Trunnions are often made use of.

The rotary movement of the shaft carrying the fan is converted into reciprocatory motion by means of a Crank or an Eccentric. In the model illustrated it is accomplished by a ¼" throw Eccentric, to the strap extension of which is connected a long rod that is coupled at its lower end to the crosshead of the pump, which in turn is secured to the piston. For demonstration purposes models of this type usually are driven by Electric Motors, but many Meccano enthusiasts make them do real work by securing them in an elevated position out of doors. By careful adjustment these models can be made to work almost as efficiently as those used in actual practice.

The older type of windmill can be reproduced in Meccano with excellent results. The appearance of age and solidity is the necessary thing to embody in these models, and this is suggested in the model shown in Fig. 2, which makes good use of many new Meccano Parts, and is built with the new E Outfit. The main structure consists of four Angle Girders surmounted by

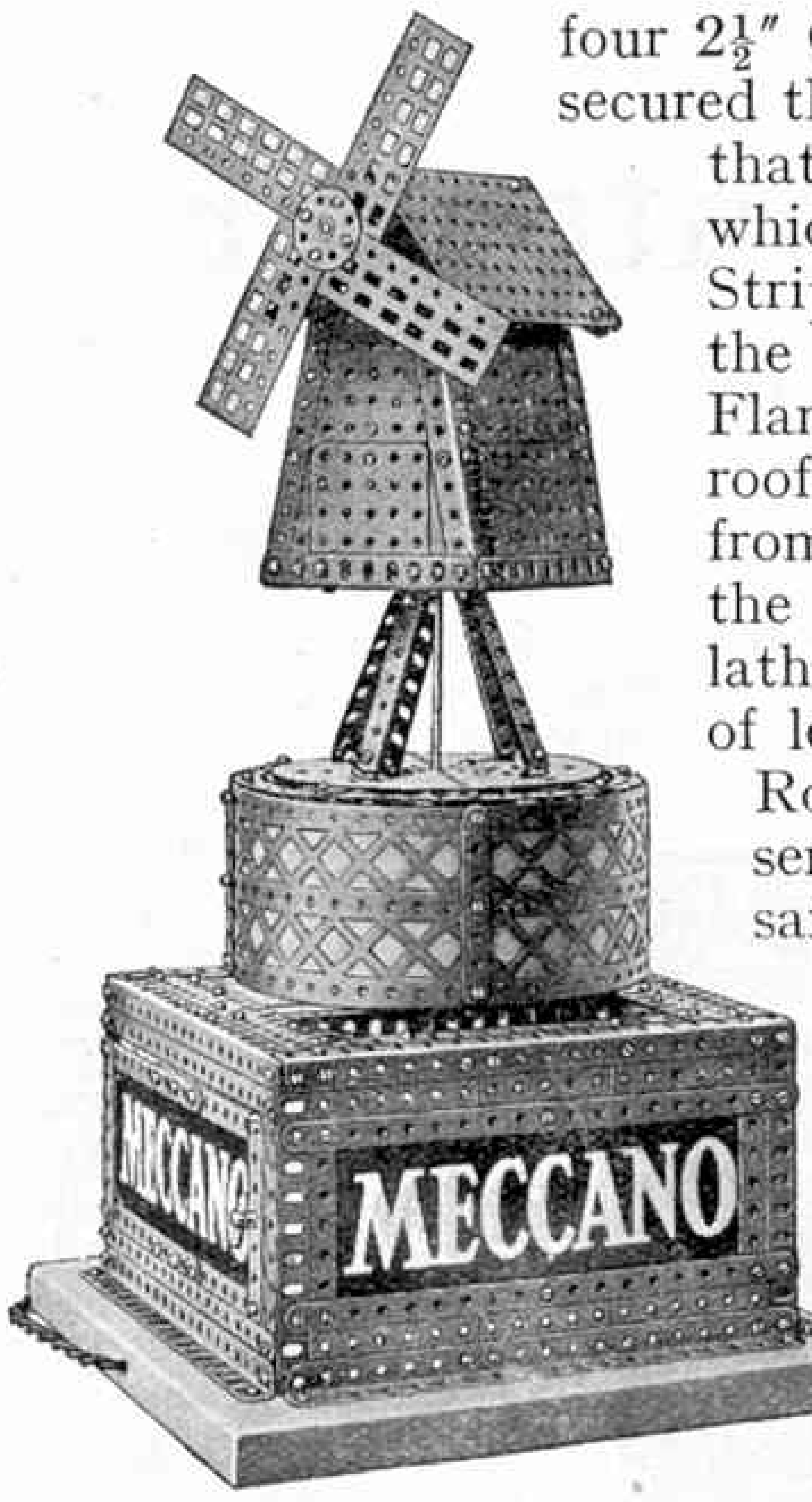


Fig. 3. A well-known and popular demonstration model of a Windmill.

four 2½″ Curved Strips. To these are secured the upper portion of the mill that carries a horizontal rod on which the sails are secured. Strip Plates are used to fill in the body of the mill, and 4½″ Flanged Sector Plates form the roof. The sails are built up from 12½″ and 5½″ Strips, and the effect of canvas or wood laths is captured by the use of lengths of Meccano Cord. A Road Wheel is used to represent the boss or centre of the sails. The small rotary fan arranged at right angles to the sail is built up in a similar manner to the fan of the windmill pump shown in Fig. 5, but Strips are used instead of Propeller Blades.

The small windmill shown in Fig. 1 is constructed in an entirely different manner. It is smaller in every way, and the sails are intended only as representations of the original and not as reproductions to scale. The body of the model is very strongly constructed of Flat Plates and Flat Girders on a framework of Angle Girders. Windows are reproduced by pairs of cross strips and the roof is built up from two 4½″×2½″ Flat Plates. The small vane at the rear is represented by a 2½″ Gear Wheel. The building of the windmill seen in Fig. 3 is carried out in a similar manner, but this model is representative of the type in which the mill turns round. A tripod carries a large post that passes up inside the windmill to about half its height, and forms a very substantial pivot for the complete model.

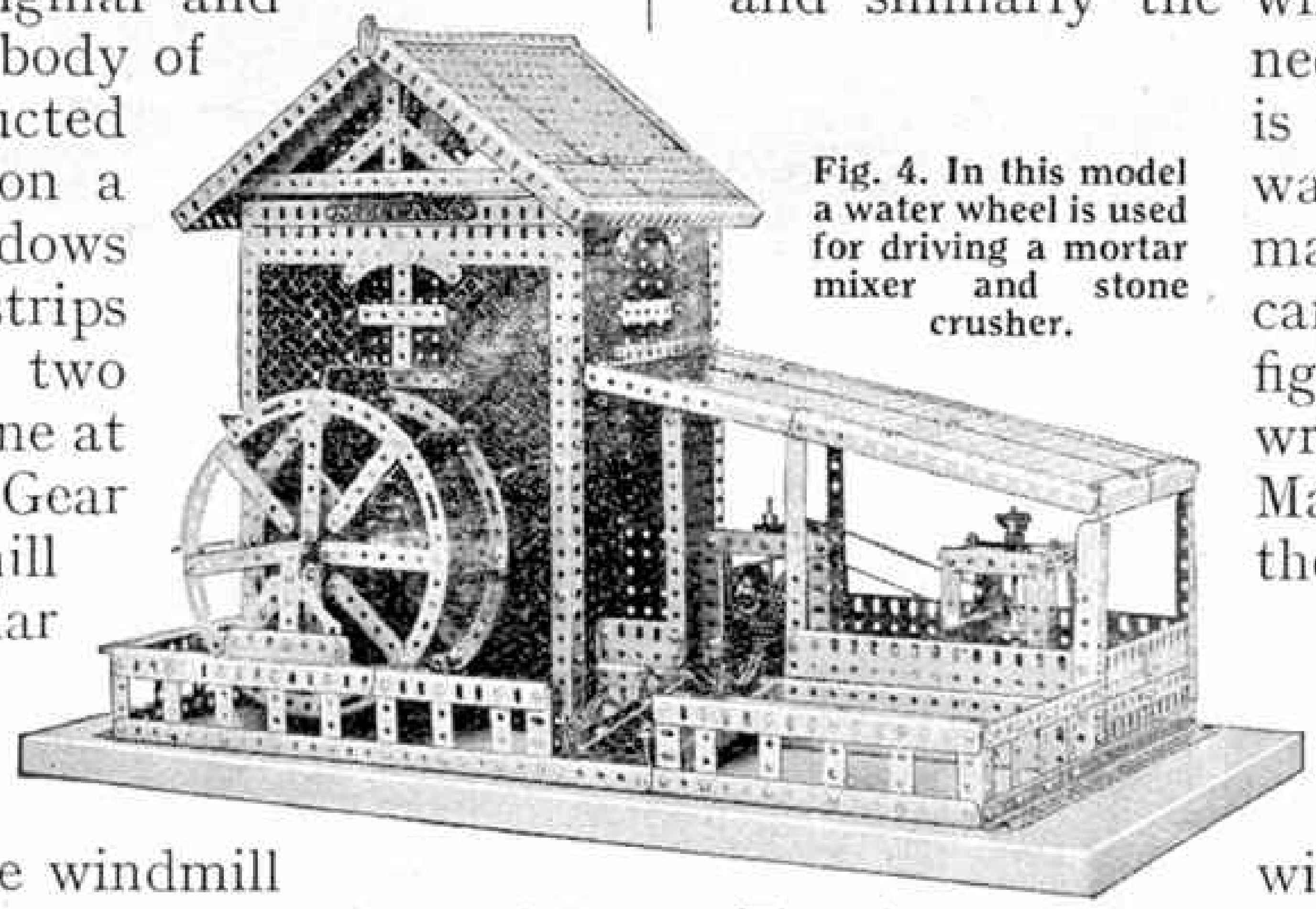


Fig. 4. In this model a water wheel is used for driving a mortar mixer and stone crusher.

In the construction of mills operated by water wheels the model-builder is confronted with problems and ideas of an entirely different nature. The main feature of course is the wheel and this should receive first consideration. In the two models shown in Figs. 1 and 4, the wheel is of the undershot type, the rims in each case being Circular Strips. These are secured by eight short Strips to Face Plates representing the boss, and are connected by floats formed from a series of Flat Girders held in place by ½″×½″ Angle Brackets. The wheel shown in Fig. 4 has floats consisting of 2½″×2½″ Flat Plates secured by Double Angle Strips.

The first of the two models is largely constructed with Braced Girders. The building, set on one side of the wheel, consists of four long Angle Girders and two Braced Girders of similar length. A small hoisting drum, set in the bottom of this building and fitted with an automatic reversing mechanism, raises and lowers an imitation sack of wheat that is to be seen plainly in the model. This additional movement greatly enhances its appearance when working, and also adds considerably to its interest. Similar movements can readily be fitted to any model windmill.

A simple but very effective setting has been arranged for the two models illustrated in Fig. 1. This consists of a board of suitable size on which the windmill and water-wheel are mounted. The board is painted green and round its edges are mounted pieces of imitation hedge. The effect created in this manner is well worth the trouble involved.

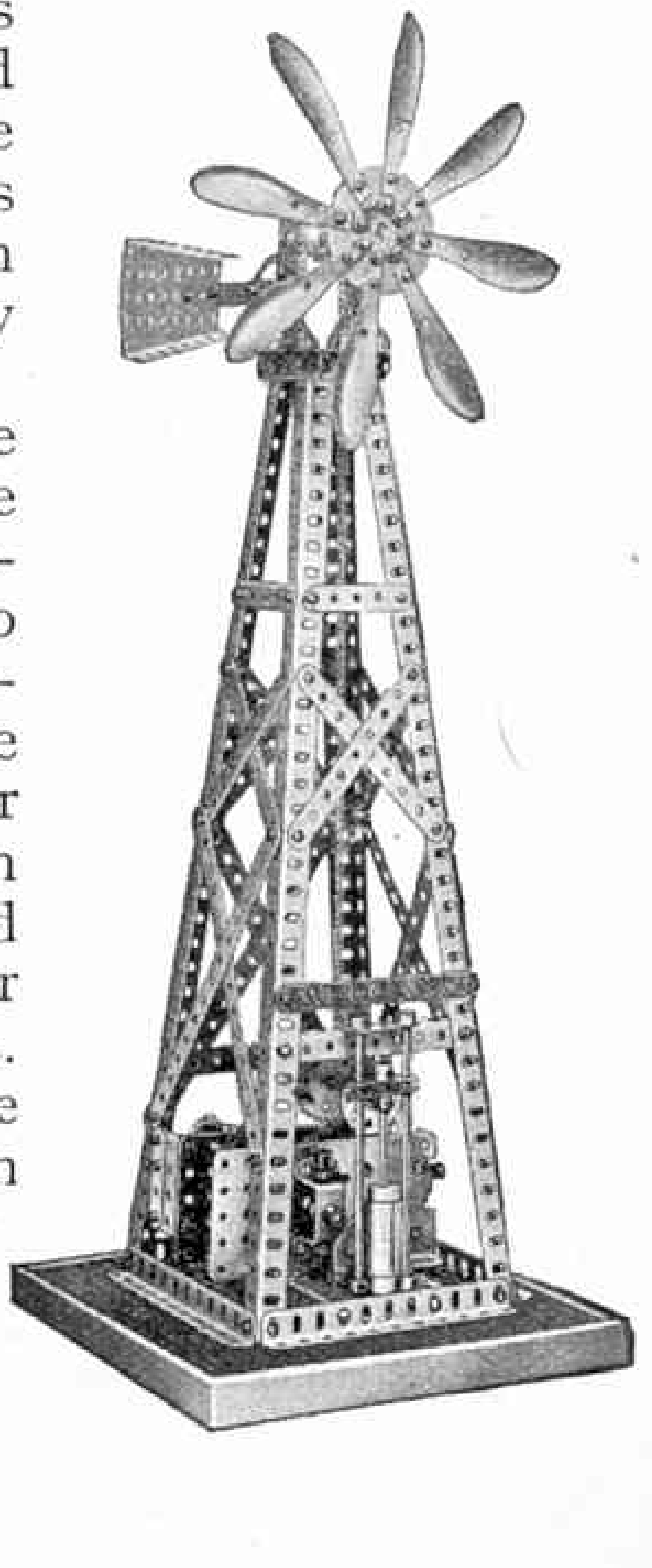
Water-wheels are put to comparatively modern uses such as mortar mixing and stone breaking, and this form of power plant makes an excellent subject for reproduction. The model water-wheel shown in Fig. 4 has two auxiliary machines coupled to it. One of these is a mortar mixer and the other a stone crusher. Both machines are very simply constructed and are driven from a motor concealed in the main building that also drives the waterwheel. Finish is given to the model by the addition of handrails and a small bridge. The bridge of course is represented as spanning the stream and consists of a 5½″×2½″ Flat Plate. Side chains are built up from 1″ Threaded Rods and loops of Sprocket Chain are added to this. The attractiveness of the model may be increased by the use of a sheet of green rippled glass to represent a stream.

Interest can be added to Meccano models of windmills and water-mills by omitting a section of the walls and fitting model grinding machinery inside. This machinery need only be of a simple character, and it is a good plan to drive it by a Meccano motor. In a windmill the sails also may be coupled up to the power unit, and similarly the wheel of a water-mill may be connected to the motor. The impression is then given that the sails or the water-wheel are driving the inner machinery, especially if the motor can be concealed. Small working figures, of which much has been written recently in the "Meccano Magazine," also can be added, and they can be so arranged that they appear to operate the various grinding and threshing machines.

If possible lights should be placed inside a model fitted with machinery and moving figures. The following plan then will be found very effective. The lights are placed behind the figures and machines, and the open space in the walls of the mill is covered with good quality tracing paper. The shadows of the moving figures then are thrown on to the screen of tracing paper, with a very picturesque effect.

The fitting of Motors into these models is a matter that can be left largely to individual requirements. There are one or two points that should not be overlooked, however, the first of these being the speed of the sails or wheel. For the purpose of realism these should rotate slowly and evenly, and this is of particular importance in windmill models. An exception to this rule is the model Windmill Pump shown in Fig. 5, and similar models, the vanes of which should rotate at a higher rate of speed than those of the older types of windmills.

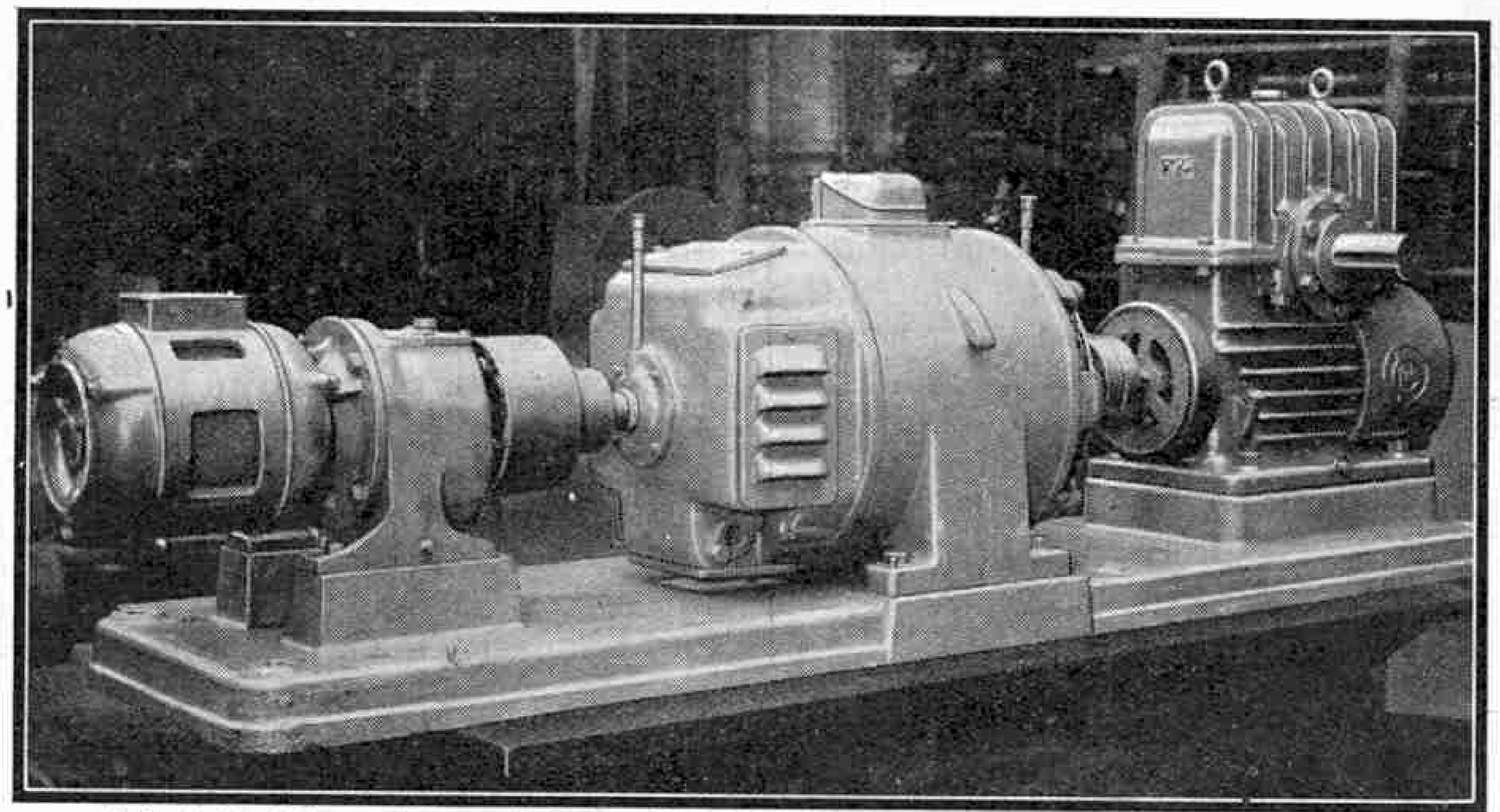
Fig. 5. A model Windmill Pump.



An Infinitely Variable Speed Controller

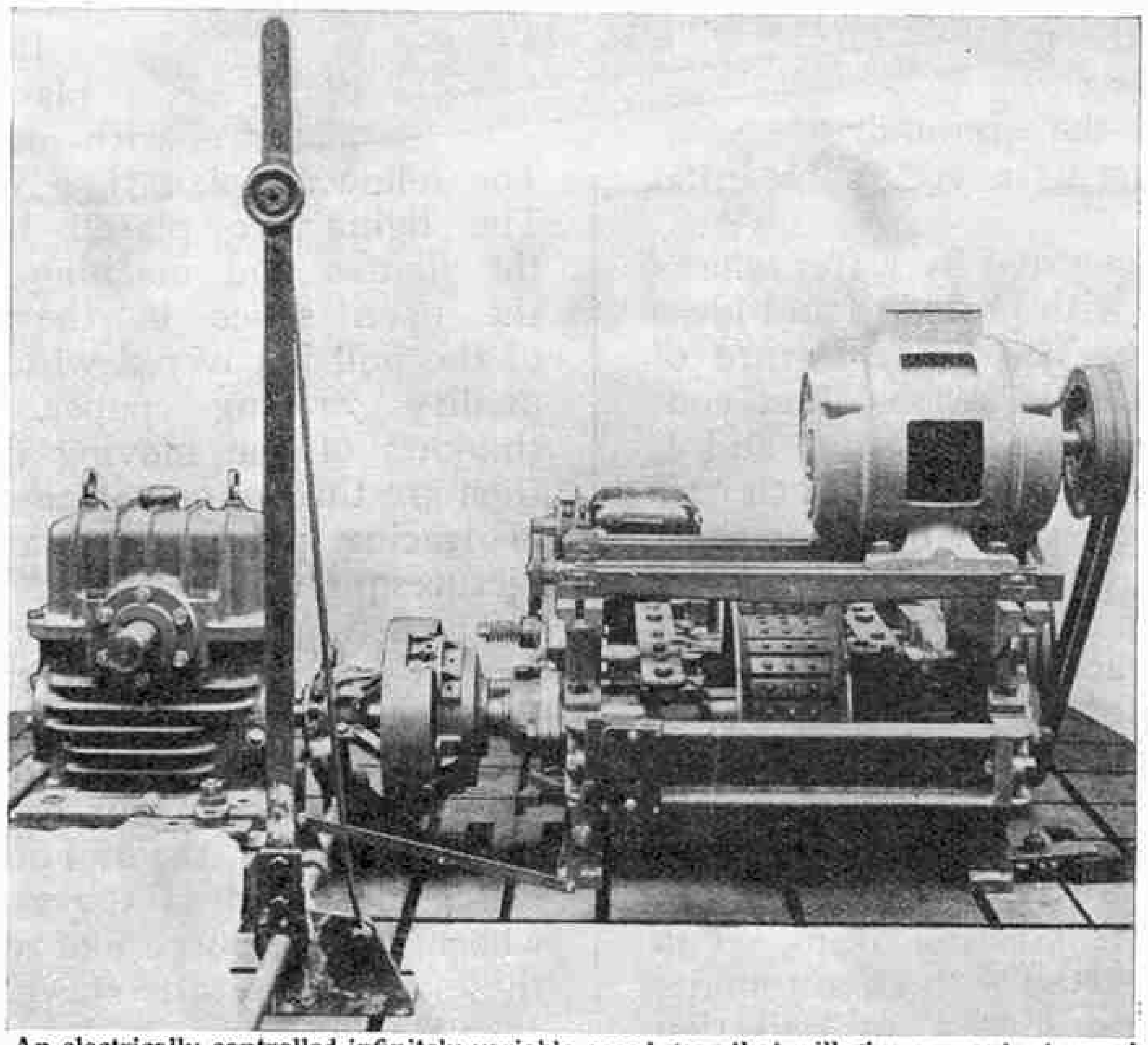
Adaptable to Machinery of all kinds

IN many branches of engineering it is necessary to use mechanisms for changing the speeds of rotating parts. For example, speed variations are essential on most machine tools in order to cut different kinds of metal at the most efficient speed. In the case of lathes it is usual to increase the speed of the revolving work as its diameter decreases so as to maintain a surface speed that is suitable for the particular metal being machined.



A Crofts Variable-speed Gear with independent constant slow speed drive for "setting-up" purposes.

Many different kinds of mechanism have been devised for the purpose of changing the speeds of rotating parts. Some of these are intended either for reducing or increasing the speed by a fixed amount, the mechanism being designed for one speed ratio only, while others enable a range of several speeds to be obtained. Included in the latter class of speed changing mechanisms is also a number of interesting devices by means of which a machine may be driven at any speed desired between a fixed minimum and a fixed maximum. A mechanism of this type, which is adaptable for use in connection with machinery of all kinds, is illustrated on this page. It is made by Crofts (Engineers) Ltd., Bradford, and one of its many applications is as a regulator for the mechanical stokers of steam power plants, where it controls the speed of the stokers automatically as the demand for steam fluctuates. The mechanism is also widely used in connection with textile machines and machine tools generally.



An electrically controlled infinitely variable-speed gear that will give any output speed between 20 and 180 r.p.m. For the photographs on this page we are indebted to Crofts (Engineers) Ltd., Bradford.

The mechanism is known as Crofts Infinitely Variable-speed Gear and consists essentially of special split expanding and contracting driving and driven pulleys that form wedge section grooves, the diameter of which can be varied infinitely between maximum and minimum limits.

Each pulley is formed from two cone-faced discs that are slideable on a shaft, and can be brought together or drawn apart as desired. The pulleys are connected by a special type flexible belt, to which are secured taper blocks or lags. These blocks are shaped at their ends to suit the angle of the inner or driving faces of the cones, and they move upward or downward on the cones as the halves of the pulley are brought together or drawn apart. The mechanism is so arranged that as the belt tread of one pulley increases in diameter the belt tread of the other pulley automatically decreases in diameter a corresponding amount.

If one of the pulleys is driven at a constant speed then by operating its cones the second pulley is enabled to run at any desired speed according to the diameter of the belt treads formed by each pair of cones. The diameter of the cones must be varied whilst the mechanism is in motion, and an infinite variation of speeds within limits determined by the size of the cones can be obtained immediately.

Movement of the cones on their shafts can be controlled either mechanically or electrically, and if desired the control can be entirely automatic in action. An advantage of electric control is that it enables a machine to be operated from any desired position, and several machines so equipped can be synchronised in action so that in any manufacturing process involving the working of two or more machines their speeds can be regulated to meet varying requirements at different stages of production.

A Crofts standard design Variable-speed Gear fitted for electric automatic control is shown in the lower illustration on this page. The Gear is operated by a motor that drives a constant speed shaft at 360 r.p.m. The variable speed shaft is coupled to a worm reduction gear through a friction clutch, which enables the driven machine to be stopped at will without stopping the driving motor. A reduction gear of 9 to 1 ratio reduces the final operating speed to a minimum of 20 r.p.m. with a maximum of 80 r.p.m., and any intermediate speed between these limits can be obtained.

The drive illustrated was specially designed for use with a machine that it was essential should always restart from rest at the minimum speed. To effect this the clutch lever on disengagement controls a reversible motor, ensuring that the variable-speed shaft returns to lowest speed.

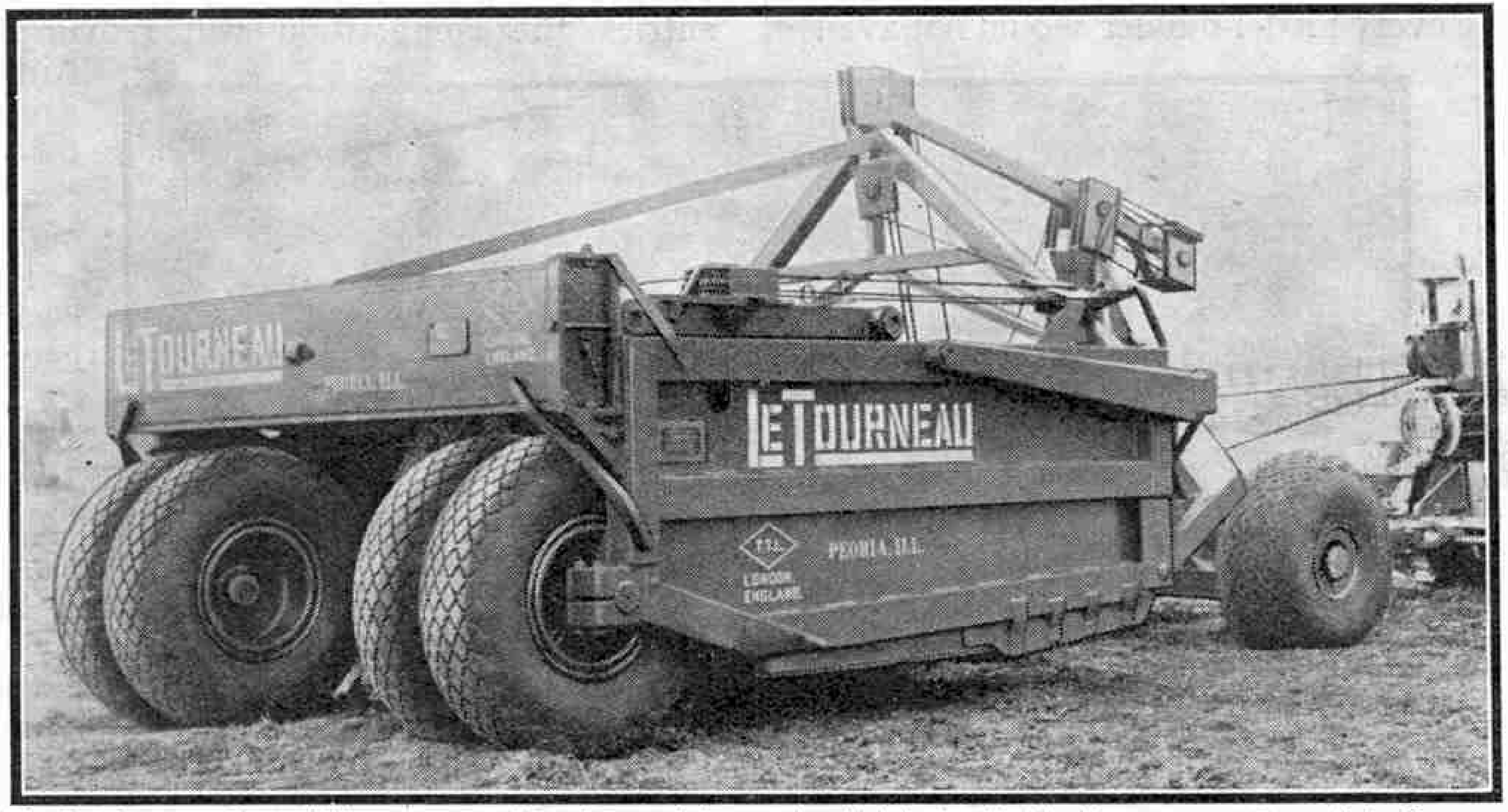
The upper illustration shows a Crofts Variable-speed Gear for use where a constant independent slow speed was required for "inching" or setting-up purposes during preparatory work. A constant speed geared motor is coupled to the rotor shaft of the main Variable-speed Gear motor by an automatic ratchet coupling, and the main motor is in turn coupled to a worm reduction unit of 24 : 1 ratio.

During setting-up work, the geared motor drives the machine at 6 r.p.m., speeds being reduced in two stages (1) geared motor 1,500 to 148 r.p.m., (2) worm reduction gear 148 to 6 r.p.m. For production the main motor is switched on, and this on acceleration operates the ratchet coupling and disconnects the geared motor. An electric relay then cuts off the current to the geared motor. When the main motor is switched off, the ratchet coupling resets itself for the next cycle of operations.

The Carryall Scraper

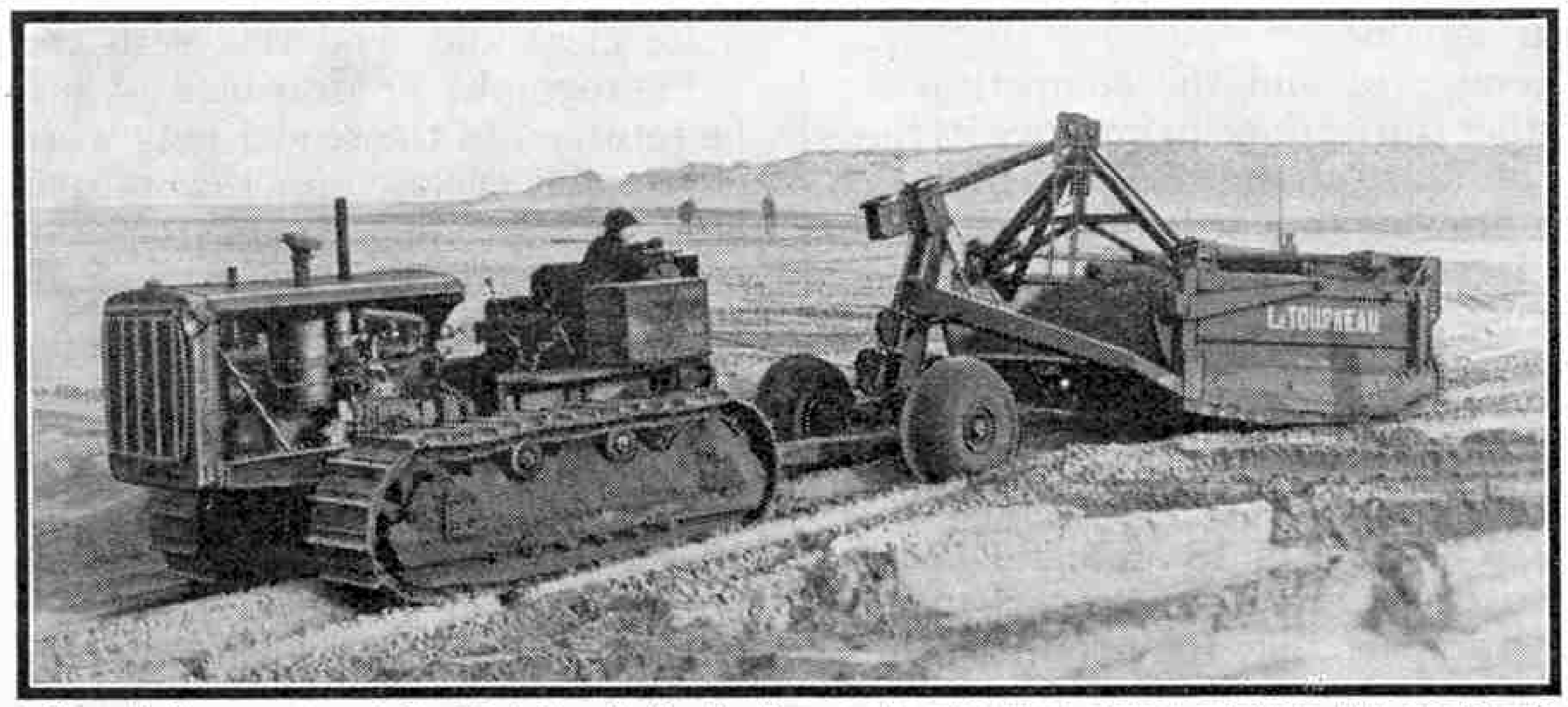
Excavating and Levelling at High Speeds

EXCAVATING is an important part of the work of the modern civil engineer, for in nearly all his tasks, such as the making of roads, railways and canals and the construction of dams, it is necessary to dig out enormous quantities of material and to deposit this in some other place, either to fill up a hole or depression of some kind, to make an embankment, or merely to get rid of it. How to move earth and rock in these circumstances of course is an old problem, for engineering work of many kinds was carried out very early in the story of civilisation. Armies of men wielding crude picks and shovels, and provided with baskets for carrying purposes, were then employed. In time their primitive appliances gave way to better tools, and eventually to machines, and many ingenious and powerful excavators, such as giant steam or electric shovels and huge draglines, are now available. Many machines of this kind have been described in the "*M.M.*"



The Le Tourneau Carryall Scraper, a speedy and powerful excavator that is described in the accompanying article. For our illustrations we are indebted to the courtesy of Tractor Traders Ltd., London.

On this page we illustrate a remarkable excavator known as the "Carryall Scraper." This digs out the material to be excavated, loads itself and automatically dumps its contents at any required point, and all these operations are carried out at very high speed. It consists of a large bowl mounted on six wheels fitted with big, low-pressure pneumatic tyres. When in action it is towed by means of a separate tractor power unit. The cutting edge is in front, and the depth to which it penetrates can be regulated instantly and accurately from the driver's seat. As the machine moves along, it scoops up the material in which it is working and this literally "boils up" from the cutting edge into the centre of the bowl, for a full load is scraped up in from half a minute to a minute and a half, the time depending on the power and speed of the tractor and on the condition of the soil excavated.



A Carryall Scraper at work levelling the site for the Promenade extensions at New Brighton. The machine is hauled by a petrol-engined tractor fitted with creeper tracks.

Part of the spoil falls into an apron that is fitted to the front of the bowl, and the rest against an unloading gate at the rear of the machine. As soon as the bowl has been filled, the cutting edge is raised clear of the ground and the machine is hauled away to the dumping ground. There its load is discharged even more speedily than it was taken up. The front apron is raised high to clear the material, which then is pushed off the front of the bowl by simply pulling forward the unloading gate at the rear.

The scraper is readily operated by one man, who manipulates levers controlling cables passing over a double drum on the power unit mounted on the tractor. One control lever raises and lowers the front apron and pulls forward the rear gate, and the latter is returned by means of heavy steel springs as soon as the lever is released.

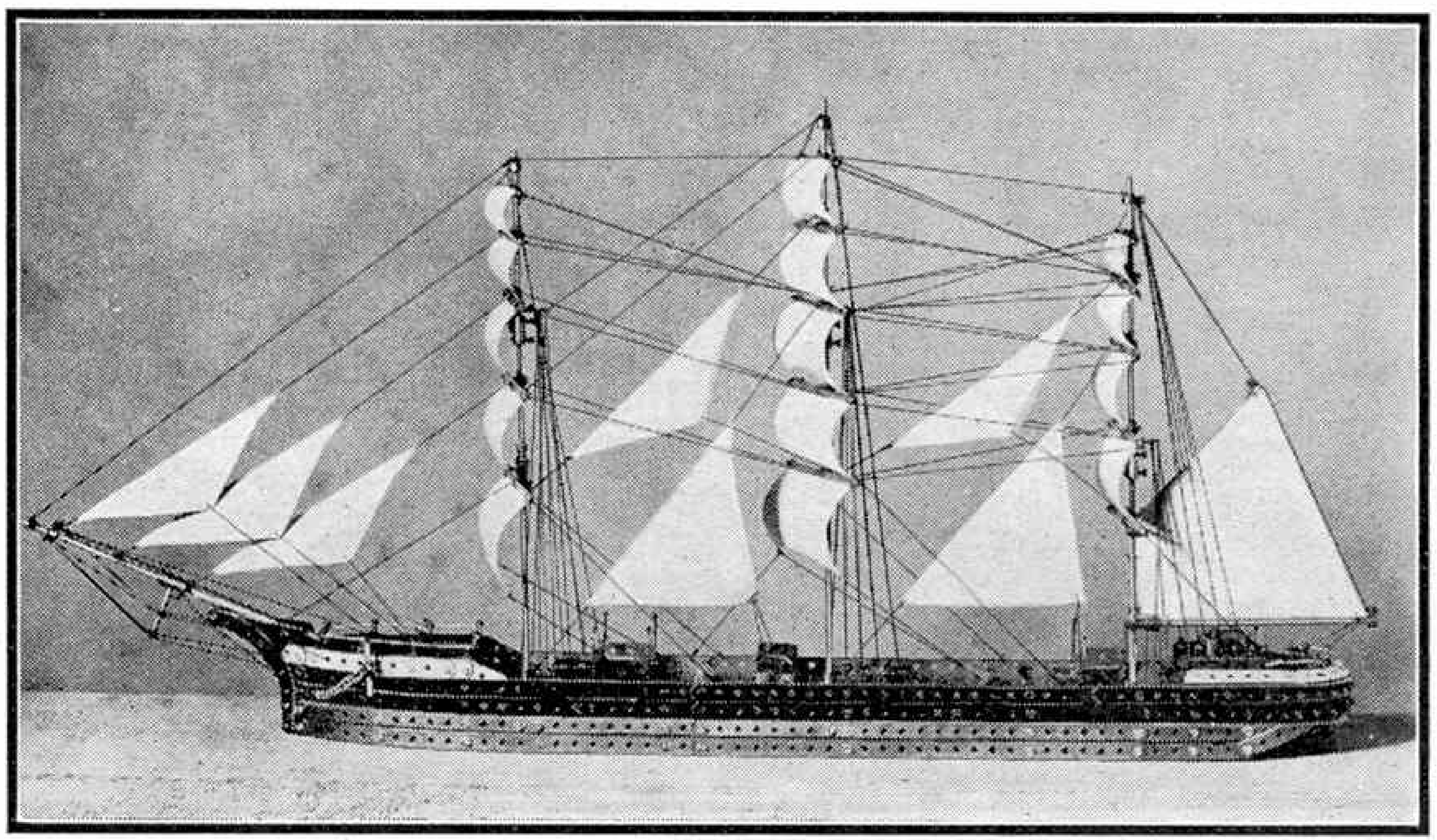
The machine is made in three sizes, with capacities of 6, 8 and 12 cu. yd. respectively. It is designed to work in sand, light and heavy soils and even in rain-soaked sticky clay, and is very strongly built of special alloy steels in order to enable it to stand up to hard wear in rough conditions. Electric arc welding construction is used in making it, and there are no separate castings or rivets to break or work loose.

The Carryall Scraper finds useful application in making cuttings and embankments, and in grading or levelling land for highways, airports or constructional work such as the building of reservoirs. It also can be used in pits and mines, and indeed for almost any work in which material has to be moved quickly.

Summer Meccano Competitions

Prizes for Model Merchant Ships

This month we announce a competition for all kinds of model merchant ships. Models of warships, and naval vessels generally, are not eligible. The competition is open to every owner of a Meccano Outfit no matter what his or her age may be, and there are no entry fees. There is no reason therefore, why every model-builder should not avail himself of this chance to win a prize.



A fine model of a full-rigged ship built by Henry Lee of Ardrossen. It is a good example of the kind of models that will win prizes in the "Merchant Ship" Competition.

Merchant ships provide plenty of scope for model-builders as there are so many different kinds of vessels to choose from, including passenger liners, cargo ships, oil tankers, dredgers and steam tugs. Readers who do not have much opportunity of inspecting actual ships at close quarters will be able to find plenty of illustrations of various types of merchant ships in past issues of the "*M.M.*" or in the illustrated papers.

Models should be built as closely as possible to scale, but unless the model is a large one it is wise not to include much detail. A small model will look better if it is simply constructed, particular attention being given to obtaining a realistic outline for the hull and the superstructure.

Every model submitted must be built by the competitor without assistance from anyone.

When the model is completed and the competitor is satisfied that nothing further can be done to improve it, the next thing is to prepare an illustration of it. This may be either a photograph or a drawing, but it is best to send a photograph if possible. It should be clearly understood that the actual model must not be submitted, and those competitors who do not possess a camera, and cannot obtain a professional photograph, should set to work to make a neat drawing.

There will be one Section only, and in order to give competitors living abroad plenty of time to send in their entries the competition will remain open until 31st August, 1936. The age of each competitor will be taken into consideration in judging the entries.

The prizes to be awarded are as follows: First: Meccano Products value £5/5/–; Second, Products value £3/3/–; Third, Products value £1/10/–. There will be also five consolation awards of Products value 10/–. We hope that every reader will send in an entry and endeavour to win the valuable First Prize.

Entries should be addressed to "Ship Model-Building Contest," Meccano Ltd., Binns Road, Liverpool 13, and each photograph or drawing must bear the competitor's name, age and full address.

If the model contains any special features that are not shown in the photographs or drawings it is advisable to write a short description that will make everything quite clear and send this with the entry.

Photographs or drawings of unsuccessful models will be returned to the sender only when a stamped addressed envelope is enclosed for that purpose. It should be noted, however, that photographs or drawings of prize-winning models become the property of Meccano Ltd., and will not be returned.

Special Summer Voting Competition

At the foot of this page is a list of 18 Meccano Parts taken from the Meccano range. Readers are asked to choose from this list (A) the part that they think is the most useful in model-building; and (B) the six parts that they think will receive the most votes when the "A" votes of all competitors are added together. Competitors should then write the names of the parts, and the Meccano catalogue numbers on a post-card, which must also bear their name and address.

Postcards should be addressed "Meccano Voting Contest," Meccano Ltd., Binns Road, Liverpool 13, and must be posted in time to reach Liverpool before 31st August, 1936, which is the closing date for all entries.

Prizes will be awarded to readers who succeed in correctly forecasting the six parts that will obtain the highest votes, or if no correct entry is received, to those whose entries are most nearly correct. The prizes are as follows: First, Meccano Products value £2/2/–; Second, Products value £1/1/–; Third, Products value 10/6. A number of consolation prizes will also be awarded.

Most Useful Parts "Voting Contest"

Select your Parts from this List

12c.	Obtuse Angle Bracket
28.	1½ in. Contrate Wheel
30c.	1½ in. Bevel Gear
44.	Cranked Bent Strip
52a.	Flat Plate, 5½ in. × 3½ in.
77.	1 in. Triangular Plate
94.	Sprocket Chain
106.	Wood Roller
108.	Architrave
109.	Face Plate
125.	Reversed Angle Bracket
127.	Simple Bell Crank
136.	Handrail Support
137.	Wheel Flange
140.	Universal Coupling
147b.	Pivot Bolt
172.	Pendulum Connection
198.	Hinged Flat Plate

Model-Building Competition Results

By Frank Hornby

"Meccanitian" Contest (Overseas Section)

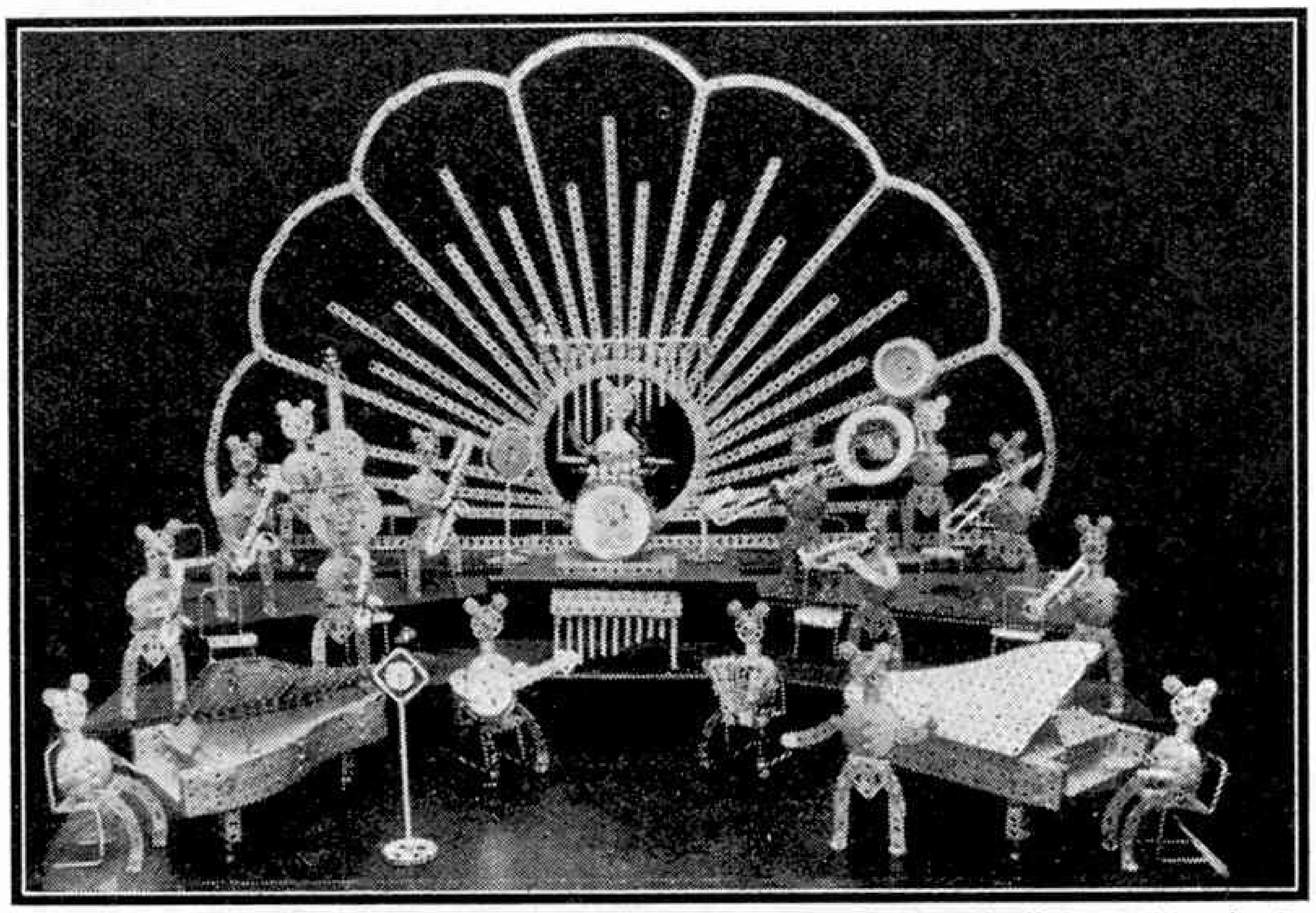
The "Meccanitian" Contest was announced in the December, 1935, issue of the "*M.M.*," and judging from the large number of interesting entries received in each Section model-builders enjoy taking part in competitions of this kind. The prizes in the Overseas Section were awarded to the competitors named in the following list:

First Prize, £3/3/-: J. Willems, Antwerp, Belgium. 2nd, £2/2/-: G. Corleo, St. Julians, Malta. 3rd, £1/1/-: J. Nie, Shanghai, China.

Meccano Products value 10/-: K. J. Orams, Blenheim, New Zealand; M. Orde, Chateau d'Oex, Switzerland; J. Thomas, Bombay, India; H. Owens, Melbourne, Australia; G. Phillips, Capetown, South Africa.

First Prize was awarded for an entry consisting of two models, the better of which is illustrated on this page. This represents a group of jazz musicians and their instruments, and is complete in every detail. Effective use has been made of Channel Segments, Strips of various lengths, and a Circular Strip, to form the decorations at the rear of the platform. Unfortunately, Willems has mutilated a considerable quantity of parts, but as the subject is one that is extremely difficult to reproduce with standard parts this lapse from good Meccano practice may be overlooked. It will be noticed that several ingenious uses have been found for many of the parts used in the group.

The second model submitted by this competitor represents a billiards match. The top of the table is a rectangular piece of cardboard 8½ in. wide and 12 in. long. The cushions are formed from channel section girders each made from two Angle Girders bolted together, spaces being left for the pockets. The table is strengthened underneath with a strong base constructed from Strips and Angle Girders, and is supported on stout legs made from Couplings.



A dance band in a unique setting that won First Prize in the "Meccanitian" Competition for J. Willems of Antwerp.

Each of the four figures comprising the group are constructed similarly to those shown in the illustration on this page, and each holds a cue, which is made from a Rod and is attached to the Meccanitian's right-hand by means of an End Bearing. The billiards balls are Steel Balls similar to those used in the standard Meccano Ball Race. Behind the table is a cue stand made from a Rod provided at its lower end with a 2 in. Pulley for a base and at the top with a Bush Wheel. The cues rest on the 2 in. Pulley, and are passed through the holes in the Bush Wheel to prevent them from falling. The top of the stand is decorated with a Handrail Coupling and a ½″ fast Pulley.

A scene in a film studio during the "shooting" of a picture won Second Prize for G. Corleo. The camera used in the scene is a good piece of work considering the simple parts from which it is made. It is mounted on a trolley consisting of a 3½ in. × 2½ in. Flanged Plate provided with four 1 in. fast Pulleys for travelling wheels. On the Flanged Plate is a tripod made from three Rods, and this supports two Flat Trunnions and two Triple-Throw Eccentrics. The former represent the body of the camera and the Eccentrics represent the film spool. The lens is a Buffer held in place by an Angle Bracket and the view-finder is a Collar.

The "operator" is made from Strips, with a 1 in. loose Pulley for his head, and he is shown looking through the view-finder. The group includes also a spot-light, which is mounted on a base plate similar to that used in the case of the camera. The tower on which the light is mounted consists of a tube made from four 5½ in. Angle Girders, and the light itself is composed of two 5½ in. × 1½ in. Flexible Plates secured round the rim of a 3 in. Pulley. Spring Cord makes admirable electrical feed cables.

A more simple model constructed by J. Nie was successful in winning Third Prize. In this model there are three Meccanitians who are shown in various attitudes and together represent competitors in an archery contest. One of the Meccanitians is supposed to be shooting an arrow at a target. The second is looking down an arrow, presumably to make sure that it is perfectly straight, and his bow rests in the crook of his left arm. The third and last figure in the group is the score keeper, who has a 1 in. Rod for a pencil.

Two of the winners of Products value 10/- failed to win larger prizes owing to the fact that they are too complicated. One of these built by K. J. Orams is a representation of a school class of seven pupils who are shown sitting in four dual desks. One of the pupils, apparently more intelligent than the others, has his hand in the air. The teacher has a severe expression on his face, which incidently is represented by a Triple-Throw Eccentric, and in one hand he is holding a stick and in the other a sheet of paper from which he is reading the lesson.

The other entry was built by M. Orde and represents a cricket match. There is little to be said about the construction of the various figures as this is carried out on quite ordinary lines. It is the expert manner in which they are arranged that attracted the attention of the competition judges.

The other three prizes of 10/- were awarded for groups representing a football match, a procession and a gang of road-menders at work, which were submitted by J. Thomas, G. Phillips and H. Owens, respectively.

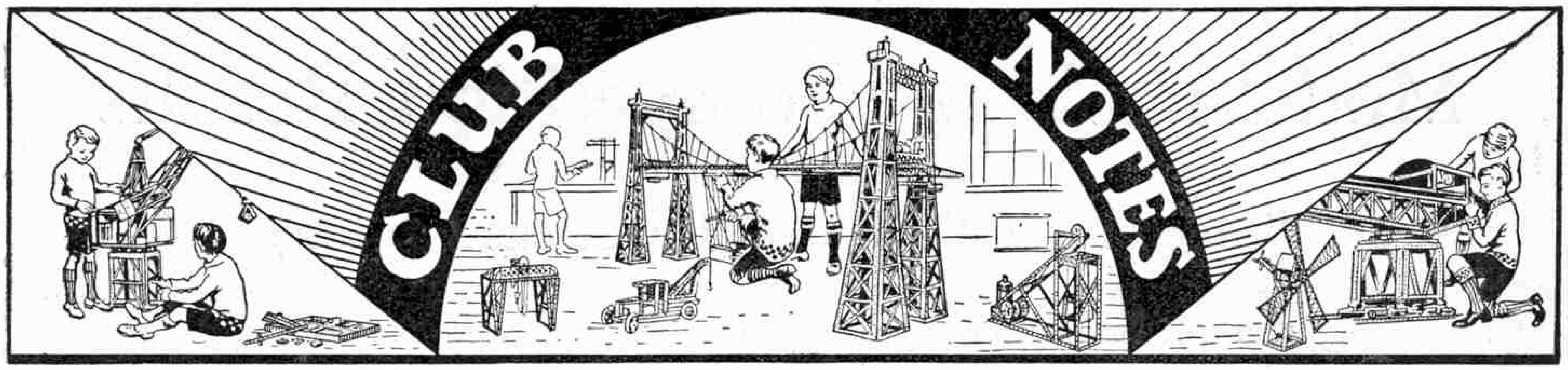
A prize of products value 5/- was won by D. McLeod, who sent a simple scene of a washerwoman at work. A "cat," made from two Double Brackets and a ½ in. loose Pulley, is curled up on the clean washing, and the woman in making an effort to drive it away, apparently has placed her foot upon the soap and slipped over! At first glance at the photographs submitted, I thought the model represented a gymnast in action!

R. Kett sent a working model of a blacksmith's shop. The subject is not original, but it is the ingenious way in which it is reproduced that attracted the judges, and earned for the model a prize value 5/-. This competitor's work is distinctly promising and I hope to receive further models from him.

"The Year's Best Model" Voting Competition

The six most popular models illustrated in the "*M.M.*" during 1935 as decided by the massed votes of competitors in this Contest are as follows: (1) C.N.R. Locomotive, built by H. G. Shorten, Regina, Canada (September "*M.M.*"); (2) Floating Seadrome, built by M. de Wilde, Antwerp (November "*M.M.*"); (3) R.M.S. "*Queen Mary*," built by P. Giese, Buenos Aires (July "*M.M.*"); (4) Traction Engine, built by C. Ingleby, Westgate-on-Sea (February "*M.M.*"); (5) Buckingham Palace, built by A. Fear, Exeter (November "*M.M.*"); (6) Barendrecht Lift Bridge, built by M. de Wilde, Antwerp (February "*M.M.*").

No competitor succeeded in placing the chosen models in the order shown above, and therefore the prizes were awarded to the competitors whose entries were nearest correct. The list of awards is as follows: 1st Prize, £1/1/-: R. M. Jeffery, Goudhurst, Kent. 2nd, 15/-: W. B. Hudson, Weymouth. 3rd, 10/-: J. Gambina, Sliema, Malta.



Todmorden Road Central School (Burnley) M.C.—A lecture on "*A Holiday in Belgium*" was given by Miss Bullock, one of the mistresses at the school, who has travelled a great deal. It was chiefly of architectural interest. Another lecture that was greatly enjoyed was given by the Leader on the topical subject of "*The Future is in the Air.*" Considerable model-building has been carried out. It is proposed to construct a Hornby layout based upon one illustrated in the "*M.M.*" Club roll: 31. *Joint Secretaries:* L. Hinton, 4, Thirlmere Avenue, Burnley, and M. Dawe, 31, Butland Avenue, Burnley.

Well Hall and District M.C.—Stamp Collecting was discussed at one meeting, and further developments are probable. The Cycling Section has resumed its activities, and some interesting runs have been arranged. Club roll: 10. *Secretary:* E. W. Quinton, 48, Beaconsfield Road, Mollingham, Kent.

Holy Trinity (Barnsbury) M.C.—The second Winter session opened well, the first night being devoted to the Annual Social. The club then continued to work through an 11-week programme, in which Meccano and Section work alternated. At the conclusion of one meeting a cinema show was given by the Leader of a neighbouring Meccano club. The annual Concert on 12th March was attended by over 150 people, and the boys who took part performed very well. An outing to Chingford has been greatly enjoyed. Members are now looking forward to a successful Exhibition, which it is hoped to hold next November. Club roll: 28. *Secretary:* Mr. H. C. Boys, 12, Stonefield Mansions, Cloudesley Square, Barnsbury, London, N.1.

Bexleyheath Boys' Central School M.C.—Interesting model-building meetings have been held. On one occasion the Leader brought along a large blue print of part of a steamer, and members greatly enjoyed studying it. The preparation of a railway layout for the club's Open Day has been discussed. Club roll: 33. *Secretary:* D. Hicks, 4, St. Audley Avenue, Long Lane, Bexleyheath, Kent.

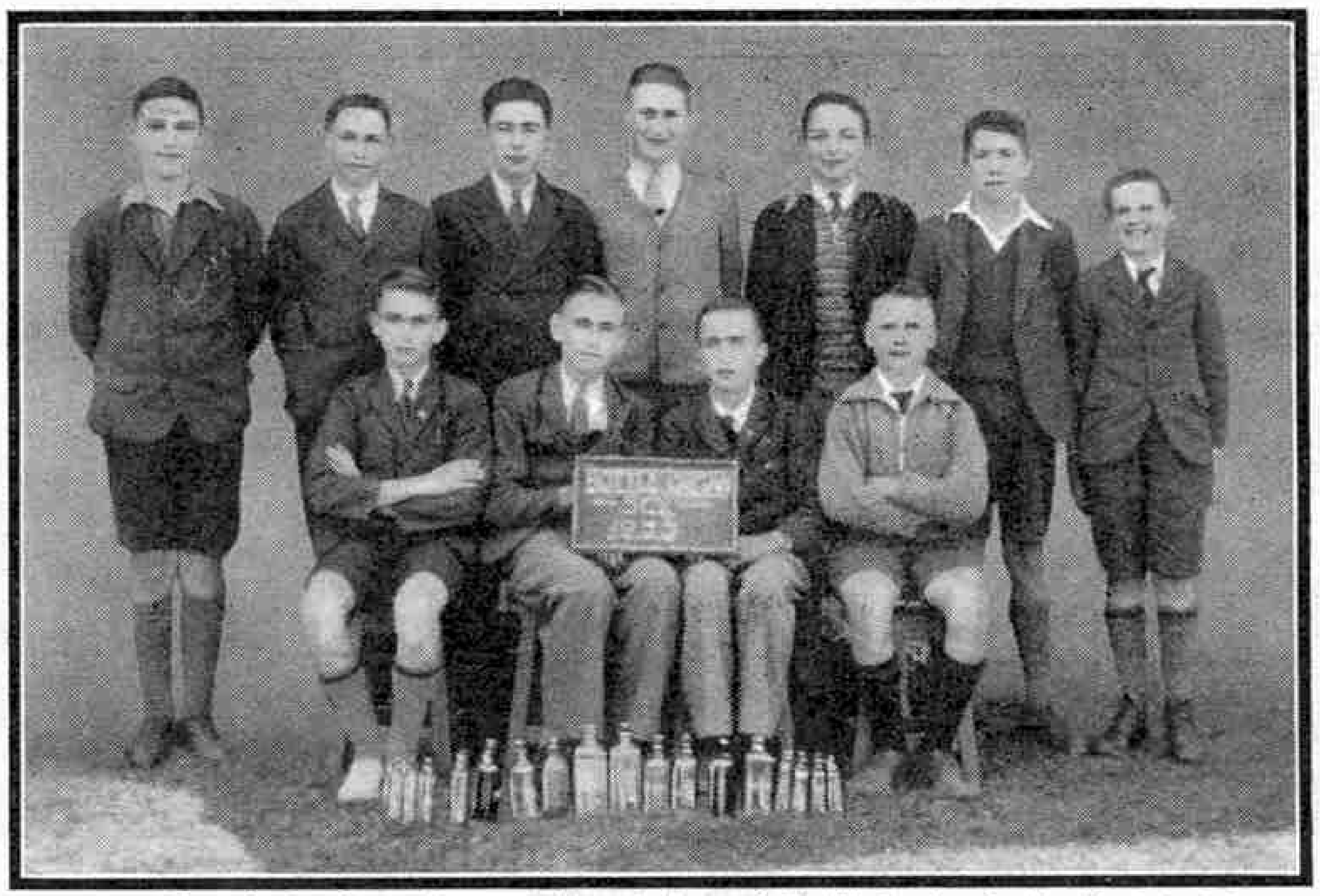
Old Charlton M.C.—Debates continue to be very popular, and one of the most interesting held recently was on the subject "*Should Airships be built?*" The opposer declared that aeroplanes were greatly superior and safer, and therefore there was no need for airships. He finally won by a large majority, only two members, the proposer and his seconder, voting in favour of airships. A debate on "*Steam versus Electricity on the Railways*" has been arranged, and also a talk on "*Motor Cycle Engines.*" Model-building activities have been concentrated on preparation for the fifth Annual Exhibition. Models completed for the event include an automatic ship coaler built from a small Outfit, but nevertheless very effective in operation; vertical lift bridge; twin-cylinder horizontal engine; an excellent modified version of the "Meccano Boxers" demonstration model, and a good show of aeroplanes built from Aeroplane Constructor Outfits. Club roll: 20. *Secretary:* Mr. W. Jaques, 60, Gurdon Road, London, E.C.7.

Bristol Grammar School M.C.—The recent illness of several of the members has slowed down model-building work. Outstanding models built have included a quayside crane based on those at Bristol docks, and a block-setting crane. At one meeting a large track was laid down on the platform in the lower hall of the school, and many fascinating railway operations were carried out. Club roll: 40. *Secretary:* N. E. Ricketts, 10, Belgrave Road, Clifton, Bristol.

Fraserburgh M.C.—Model-building was temporarily suspended while new tables were built to enable members to construct their models under better conditions than hitherto. Cycling and Model Aeroplane sections have been formed. The Cycling section has its own committee, and plans are being made for a 10-days' tour of Scotland during the summer holidays. Three of the members have large light tents, and it is hoped that full advantage will be taken of this valuable equipment. The Model Aeroplane section has six members, and interesting flights have been achieved when weather conditions have been favourable. The club stock of Meccano Parts has been increased, and the equipment of the Junior section has been enriched by the addition of a complete Hornby "Flying Scotsman" Train Set. Club roll: 28. *Secretary:* W. J. Dawson, Phingask, Fraserburgh.

Wheelwright Grammar School M.C.—Model-building has been the chief occupation recently, and members are becoming very proficient in constructing Meccano models. A film show and a visit to the gas works have been arranged. Club roll: 14. *Secretary:* D. G. Thackrah, 2, Highroyd, Northfields, Dewsbury, Yorks.

Exeter M.C.—Cycling is very popular, and some enjoyable runs have taken place. One of the most appreciated features of the second Winter session was the Leader's practice of reading an exciting adventure story during the Monday evening meetings. A total of 52 models were built during that session, as compared with 35 during the corresponding period last year. They covered a remarkable variety of subjects. and in addition to the usual output of bridges, cranes, ships and motor cars, many models of a novel character were produced, including gondolas, buoys, caravans, horse and milk float with driver, a statue of Sir Francis Drake, a drinking fountain and a model of Will Hay with one of his pupils. Club roll: 60. *Secretary:* K. G. Sercombe, 18, Normandy Road, Heavitree, Exeter.



The "bottle" orchestra formed among the members of the Thebarton Junior Technical School M.C., Torrensville, South Australia, by Mr. E. S. H. Gibson, the Leader. The members' "instruments" are ranged in front of the group. This club was affiliated with the Meccano Guild in December 1928, and has made excellent progress.

Hornsea M.C.—This club recently celebrated its sixth birthday. Interesting lectures have dealt with aeroplanes, wireless, mathematics, "*The Wiltshire Downs*" and "*How We are Governed.*" The Engineers' section have visited the L.N.E.R. hydraulic generating station, Hornsea. The party divided into two groups, one making a tour of the station under the guidance of the Hydraulic Engineer, and the other being escorted by the Electrician. This was followed by a tour of the workshop, and the visit concluded with a ride on the overhead electric crane across the building. Club roll: 14. *Secretary:* P. Thom, 5, Alexandra Road, Hornsea.

Islington M.C.—An interesting and varied programme has been followed, and has included talks, model-building, Chemistry experiments, and readings from the "*M.M.*" The latter part of most meetings is spent in playing games. A film show has been given by the Leader. Club roll: 17. *Secretary:* K. V. Dines, 70, Thornhill Road, Barnsbury, London, N.1.

Mallow M.C.—Members have been chiefly occupied in extensive preparations for the celebration of the club's birthday. The two former Leaders have been invited to attend the event. Substantial additions have been made to the club library. The subject of a recent Lecture Night was "*The Story of Our Ships,*" and was much enjoyed. Club roll: 16. *Secretary:* M. D. Hickey, 42, Ballydaheen, Mallow, Co. Cork, I.F.S.

AUSTRALIA

Sydney M.C.—Model-building and Hornby Railway operations have chiefly occupied the attention of the members. Further additions to the club layout have been made, to represent a branch line to Carinnys. The branch is 56 ft. in length. An interesting lecture on "*Tasmanian Railways*" has been given by the secretary, who recently returned from a six months' visit to Tasmania. Some excellent outings have been planned, and these include an excursion to Toronto arranged in conjunction with the Railway Touring club. Another excursion planned jointly with that club is to Austinmer on the south coast, and it is anticipated that a 10-coach train will be required to convey the party. It is proposed to name the special train "*The Meccano Club Express,*" and to have the name displayed on the locomotive and coaches. Club roll: 50. *Secretary:* T. Watson, Box 1749JJ., P.O., Sydney.

SOUTH AFRICA

Malvern M.C.—The membership of both the boys' and girls' sections of the club continues to increase. Very interesting models have been built, including racing cars, horse and cart, motor bus, double drop hammer, electric radio gramophone and an electric combination lock. Outdoor activities have included swimming and cricket. At a recent business meeting, the matters under discussion were concluded in good time and the remainder of the evening was given over to items by members. Those members who failed to contribute an item to the impromptu programme were fined threepence, and as there were several shy ones the club funds benefited appreciably! The evening was a great success, and resulted in many requests for more entertainments of this kind, as it is evident there are some talented members in the club. Club roll: 85. *Secretary:* B. Saunders, P.O. Box 8, Cleveland, Johannesburg.

EGYPT

Zagazig M.C.—A new clubroom has been obtained, which is more centrally situated than the previous one. A tea party attended by members and many of their relatives and friends was greatly enjoyed, and a feature of the event was a comic play by some of the members. A Correspondence section has been formed to establish correspondence with boys in all parts of the world. Visits have been paid to places of interest in Cairo, and on one occasion the Cairo M.C. was visited and a very happy evening was spent there. The models displayed by the club at the Exhibition of Egyptian Industry in February last included a large passenger liner, bucket dredger and model steam engines, and all were greatly admired by the many visitors. The club co-operated with the Cairo M.C. in this display. At a recent Visitors' meeting an interesting lantern lecture on "*The life of Henry Bessemer*" was much enjoyed. Club roll: 20. *Secretary:* A. Y. Ayoub, Sharia El Sikka, El-Hadid, Zagazig.

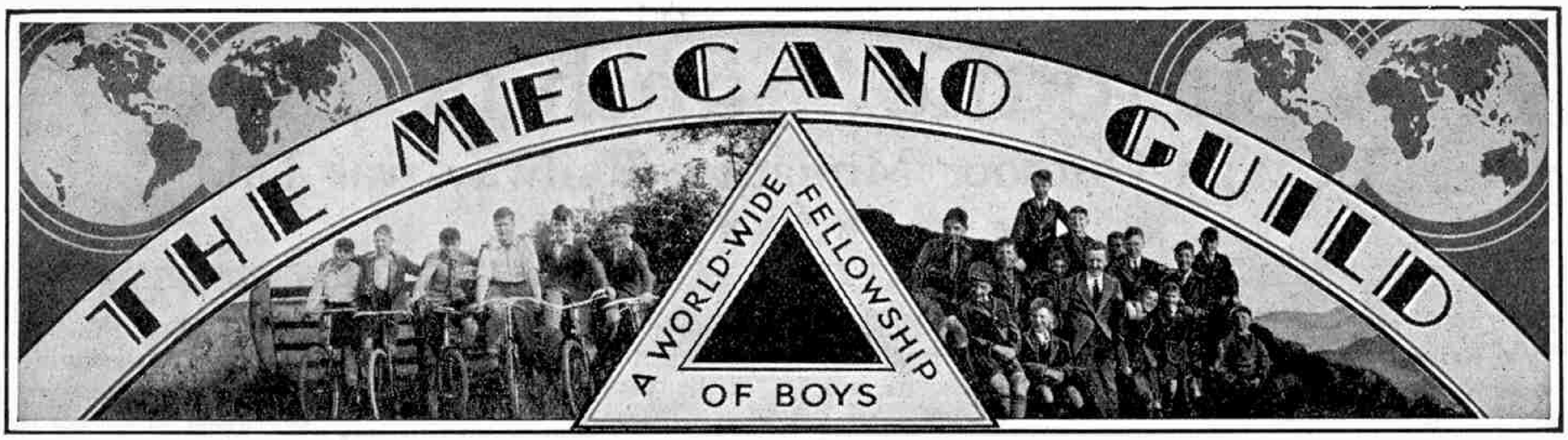
NEW ZEALAND

Christchurch M.C.—The club roll has been revised, and the names of members who have not attended during the past club year have been struck off the roll. The membership therefore now consists entirely of boys who are really keen Meccano enthusiasts, and this fact augers well for the future success of the club. Occasional Games Evenings are very popular, and always produce a great deal of fun. Preparations are well in hand for the club Birthday Evening, when the parents and friends of members will be invited to attend and join in the celebration. Club roll: 22. *Secretary:* L. W. Best, 28, Circuit Street, Strowan, Christchurch.

Unaffiliated Club

AUSTRALIA

Maylands (West Australia) M.C.—A Concert in which most of the members will take part is being organised to raise funds. A visit has been paid to the Australian Glass Manufacturers Ltd., East Perth, where a most interesting tour of the works was made under the guidance of officials of the company. Club roll: 17. *Secretary:* M. Thomson, 13, Kennedy Street, Maylands, Perth, West Australia.


THE MECCANO GUILD
A WORLD-WIDE FELLOWSHIP OF BOYS

Enjoying Outdoor Activities

Outdoor activities are now in full swing with practically all Meccano clubs, and the reports I have already received indicate that this is going to be a more successful summer than any previous one, regarded from the Guild point of view. With a few exceptions, due to unusual circumstances, all clubs are making definite arrangements to carry on club life throughout the summer. There are many signs that the old practice of allowing clubs to practically die out during the summer has gone. Most Leaders now realise that this involves the members missing a great deal of splendid outdoor fun, and also makes it very difficult to bring the club together again for the first Winter session.

Master K. G. Sercombe, who recently served for a short period as Secretary of the Exeter Meccano Club. This club is now in its 12th year, and is one of the most successful affiliated with the Meccano Guild.

Summer Camping Grounds

In my April notes I dealt with the subject of summer camps. I would like to supplement my remarks there by drawing the attention of Leaders to the recently-issued 1936 edition of the Great Western Railway Company's booklet *"Camping and Rambling Holidays."* This booklet gives a list of camping sites throughout the area served by this railway. In the case of each site the name and address of the owner or tenant is given, together with sufficient information to enable a club Leader to decide whether this particular place would be suitable or not. The amount of land available is given, the nature of the surrounding country is indicated, and in addition, an important point that is easily overlooked—the whereabouts of the nearest drinking-water supply. The booklet may be obtained on application to the Superintendent of the Line at Paddington Station, London, W.2, or to any G.W.R. London or provincial office.

The country served by the G.W.R. is varied in character. The sites mentioned in the booklet include both inland and seaside camp positions, and there is a wide choice open to those who wish to obtain this healthy and interesting form of holiday. Similar information may be obtained from the other British railway companies by officials of those clubs whose headquarters are in the parts of the country that they serve, and I advise Leaders who are interested to make immediate enquiries. Many important concessions are made by the companies in regard to fares for camping parties, and full particulars of these concessions can be obtained from the local railway station.

Organising Interesting Rambles

It is hardly to be expected that all the members of a club will be keen on cycling or playing cricket, and it is up to Leaders to arrange some other form of outdoor activity for those who do not wish to take part in these pastimes. In many clubs the solution to this problem has been satisfactorily solved by arranging walking expeditions, generally once a week, to various places of interest in the neighbourhood. Boys do not care for rambles just for the sake of walking, however, and some object must be provided in order to arouse interest; the walks must therefore be planned with this object in view.

The best plan is for the Leader to borrow from a local library one or two books dealing with the district. By studying these, together with a large scale map, he will soon acquire a really surprising amount of interesting knowledge, which he can impart to the members during the rambles in a chatty manner that will succeed in holding their attention. A happy result of rambles thoughtfully prepared in this way is that the eyes of the boys are invariably opened to things of great interest which they had never considered seriously because they were too familiar and were close at hand. It is not unusual for one or more members of a party to remark during a ramble that they have passed a particular place scores of times but have never known before that there was anything interesting about it.

If the Leader has any knowledge of botany, birds, geology, etc., his task is all the easier, but even if he has no particular leaning toward those subjects he can, by a little study, acquaint himself with them sufficiently to be able to make the rambles enjoyable to all taking part.

Australian Club's "Bottle" Orchestra

Most people know that if the neck of an empty bottle is held against the lower lip and air is forced across the opening a note is produced. With a little practice it is possible to produce the note any time it is required. These two simple facts inspired Mr. Gibson, the Leader of the Thebarton Junior Technical School M.C., Torrensville, South Australia, to organise a "bottle" orchestra among the members of the club. The idea was taken up enthusiastically and a large orchestra was soon formed, as is borne out by the photograph of its members and the bottles they use, which is shown on the opposite page. This novel orchestra was employed to illustrate points made in broadcast talks to schools by Mr. Gibson through the Australian national wireless stations 5C.L. and 5C.K.

The manner in which the desired musical effect is obtained is quite simple. If water is added to the empty bottle the note obtained is raised in pitch, and therefore by taking bottles of different sizes and adding water to each of them a set of notes corresponding to a musical scale can easily be obtained. If each bottle is given to a boy to hold and blow with the correct timing, quite effective music can be produced. The Leader, or any other senior member of the club who is musical, can easily arrange the music for the players. If the club lacks any suitable member for this task it is a good plan to number the bottles from 1 to 8 and to write the music in numbers.

During the first practice of the Thebarton "bottle" orchestra only single notes were played, but later, when the members had become more proficient, four-part harmony was produced. It is often possible to give two or three bottles to the same boy; his music being written in different colours to correspond with these various bottles, so that he can employ the correct bottle for each note. By this means the number of players can be substantially reduced and the management of the orchestra considerably improved.

Proposed Clubs

Attempts are being made to establish Meccano Clubs in the following places, and boys interested should communicate with the promoters whose names and addresses are given below:

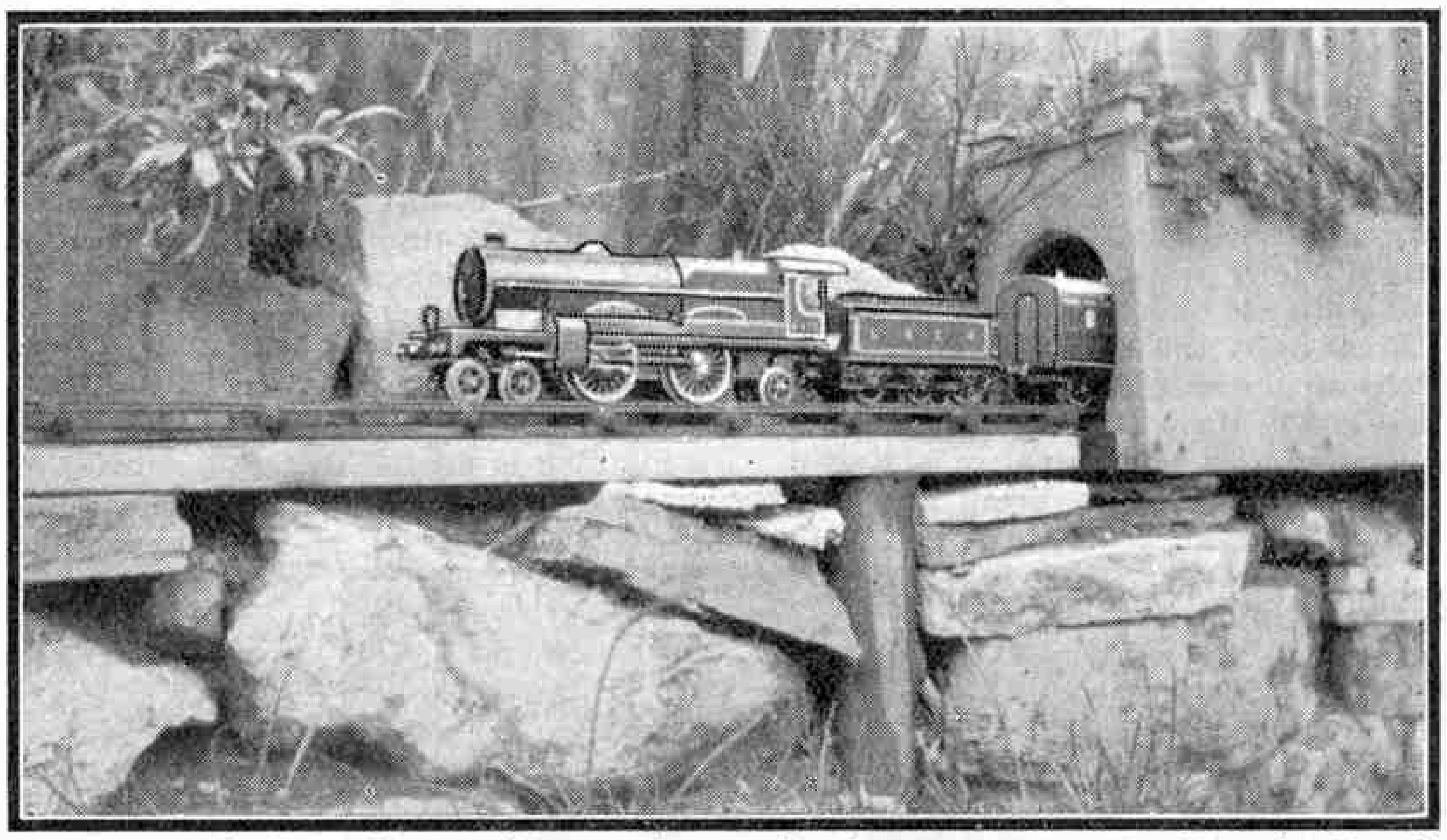
CARLUKE—J. W. S. Scott, "Westfield," Carluke, N.B.
KIRKBY LONSDALE—N. Forsyth, 57, Main Street.
NEATH—T. M. Sullivan, "Wenvoe," Eastbourne Terrace, Penrhieutyn.
WELLINGBOROUGH—P. Henson, 24, Croyland Road.

A Visit to the "Sunshine Lines"

How an Outdoor Miniature Railway was Laid

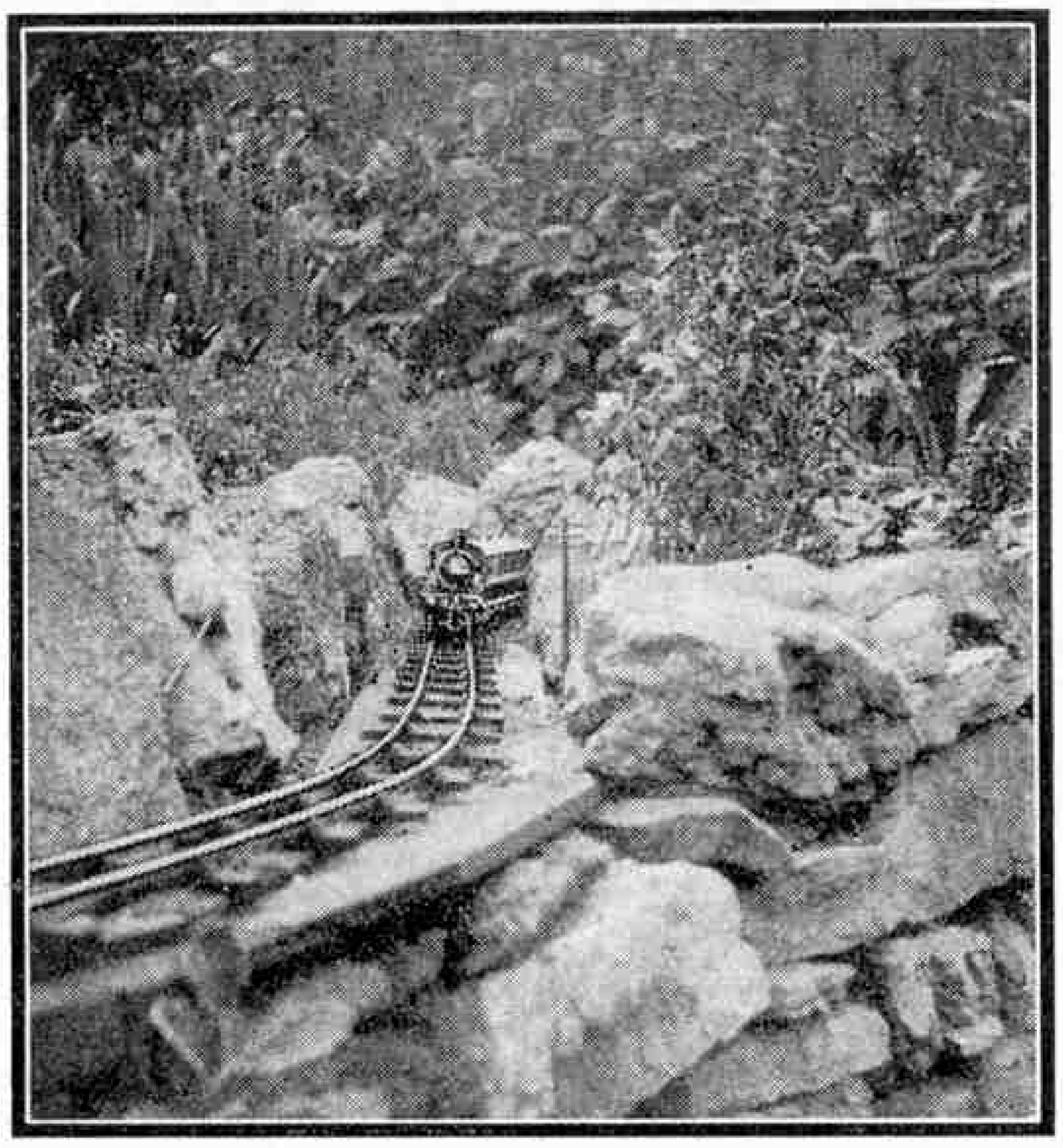
By "Rosco"

WITH the approach of the summer many Hornby Railway systems are put away, or at least are somewhat deserted, while their owners seek pleasure and health out of doors. Even since the time when I commenced the miniature railway hobby I have wished to be able to continue my train operations and to enjoy the summer at the same time. To make this possible it was eventually decided to construct an outdoor line in the garden. Even the smallest of gardens is larger than many a room and the beauty of the summer flowers need not be disturbed by the presence of a shining miniature railway track running in a business-like manner amongst them. Rather will the garden have an added interest; and the railway will be much more like the real thing than is possible indoors, by reason of its more natural surroundings.



A Hornby No. 3 "Flying Scotsman" Locomotive emerging from the tunnel on the "Sunshine Lines." This photograph shows how the baseboard is arranged on posts, with large stones packed beneath it.

It was necessary, of course, to lay the track on a foundation of boards arranged above the level of the ground so that the amount of stooping involved in handling the engines and stock would be reduced. Actually, as can be seen by the accompanying illustration of the Hornby *"Flying Scotsman"* emerging from the tunnel, the line now described is about sixteen inches above the level of the lawn from which the photograph was taken, and about eight inches below the level of the flower bed along which it runs. Gradients are not really a desirable feature and unless the ground traversed is dead flat very much better running is obtained by making frequent use of the spirit level when fixing the boards, thus keeping them as level as possible. This may necessitate embankments, cuttings, bridges or tunnels, and these greatly improve the line, giving it an appearance of realism that is quite unobtainable in a room.



A picturesque scene on the outdoor railway described on this page, showing a train passing through a rock cutting.

A simple method of securing the boards was adopted, that of driving into the soil short posts of a few inches long, nailing the boards to their tops at ground level. Where the line was required to be a foot or more above ground level longer posts were used. It is well worth while to make the boards as rigid as possible for then the laying of the track on them is much simpler. Needless to say as the posts and boards were intended to remain out in all weathers, they were given a good coat of wood preservative. To prevent the boards from warping they are nowhere less than three-quarters of an inch thick; and a width of from five to seven inches is found suitable for a single track.

The next step was to lay the permanent way. This is made up of steel rail fixed in chairs on wooden sleepers, and the whole is secured by means of fine nails or screws through the sleepers into the baseboard. The layout consists of a continuous single track in the form of an oval and the complete circuit measures about 36 yards. The Hornby No. 2 Special Tank accomplishes this distance comfortably with a load of six or seven wagons. The No. 3C *"Flying Scotsman"* takes three bogie coaches round equally well, both of these being good performances for a clockwork mechanism.

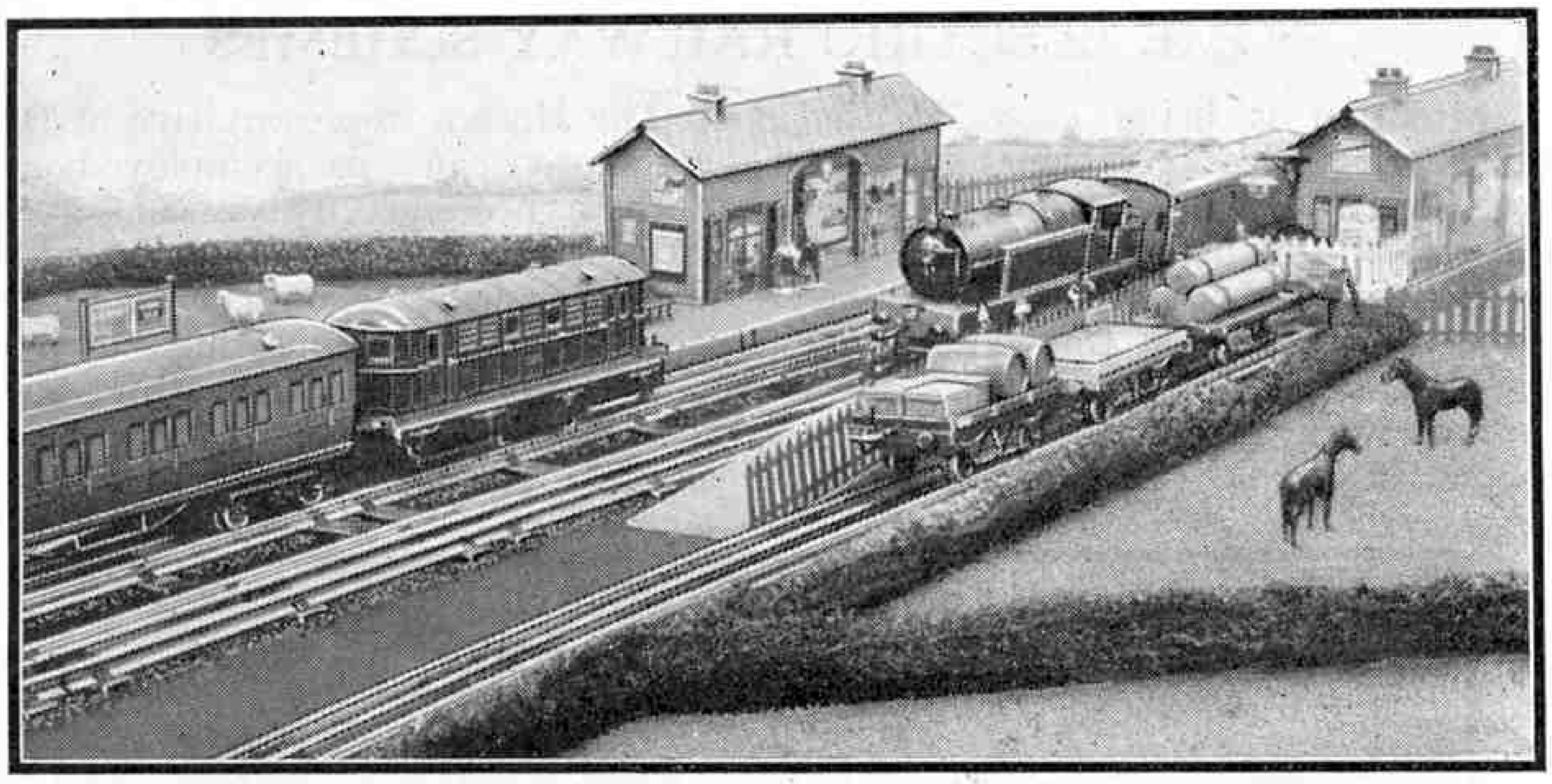
Starting from the station the train gets up speed along a stretch of straight track. Immediately before entering a yard-long tunnel the track swings a little to the right and back again. Another three yards or so of straight and a wide curve ensues; then higher ground is encountered as a cutting is entered. From this a straight stretch of about four yards precedes another sweeping bend, in a second cutting through literally "towering" rocks. The line emerges onto the straight again and continues so for a distance of about ten yards. At the end of this is a further curve and then come three points giving access to the goods sidings and the engine shed. With the last curve, crossing a miniature ravine about eighteen inches deep by a plate girder bridge, the starting point is once more brought into view.

The station and the engine shed are home-made and like the baseboard and track are permanent fixtures.

Using the Two-Train Transformers

By "Tommy Dodd"

IN the December 1935 "*M.M.*" were mentioned the two special Meccano Transformers that are now available for the operation of two trains at once. These are known as Type T22M for 20-volt railways, and Type T26M for 6-volt railways. This month I propose to deal with the method of using these Transformers and to show the increased possibilities that their use affords to the owner of a Hornby Electric Railway system.



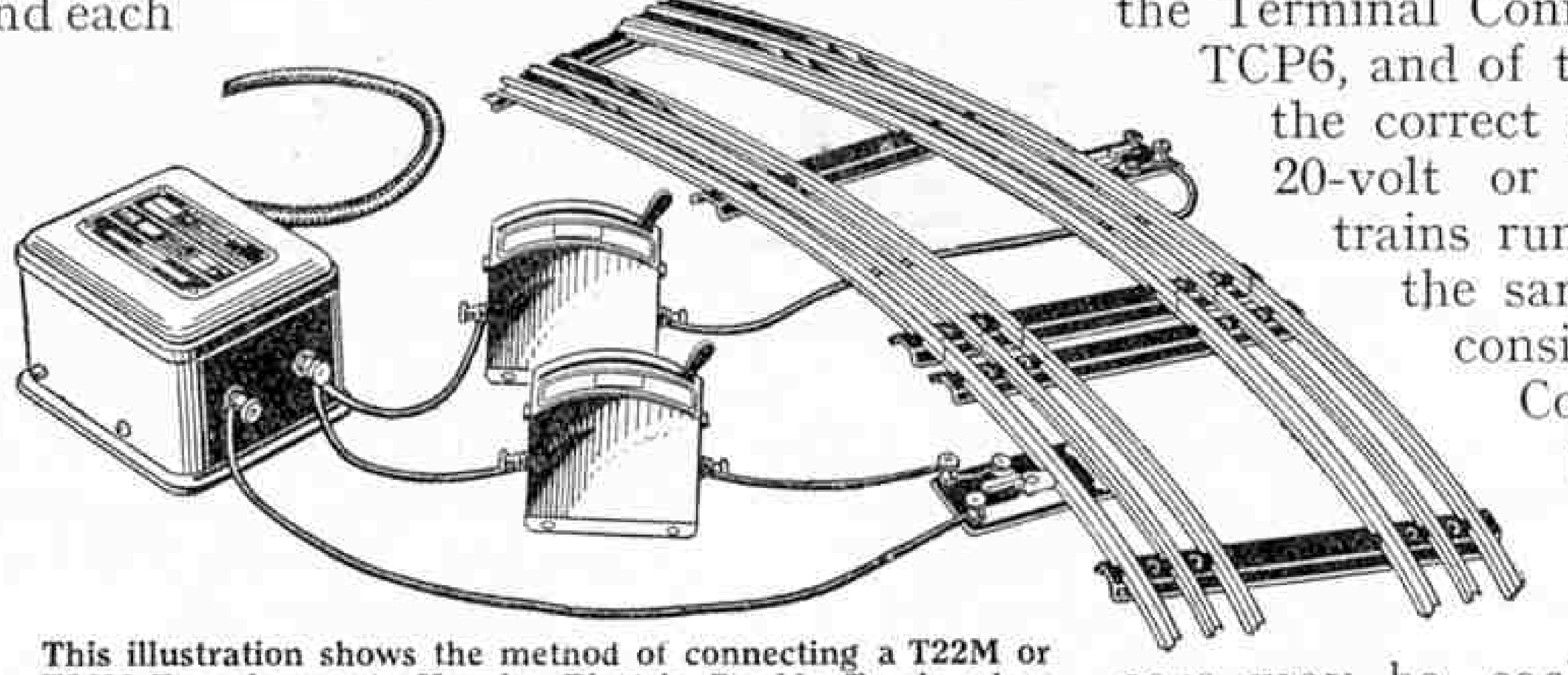
A section of a Hornby electric double track railway with two trains passing one another. This is a typical example of a layout requiring a two-train Transformer of the type referred to on this page.

It is a simple matter to instal either of these Transformers on a miniature railway layout. They do not incorporate any control gear nor have they any provision for electric lighting. They have therefore only one pair of terminals, so that no difficulty should be experienced in arranging the connections from the Transformer to the track according to the instructions packed with each Transformer. When the two trains are on the same track the connections from the Transformer are the same as if a single locomotive is being operated from a T20M or T6M Transformer. Under these circumstances, as there is only one Resistance Controller in use, the two locomotives will start and stop together and they will also run at the same relative speeds, according to their type and the load behind each of them.

Possibly the Hornby railway owner will not require to run the two trains as separate units. He may perhaps wish to have two engines on one train, either as a novelty or as a matter of operating convenience. The two locomotives coupled together in this way, as the train engine and the pilot engine of a double-headed train, will work in complete harmony with one another.

So far we have assumed the use of only one track; but undoubtedly the greatest fun is enjoyed when there are two separate tracks, each with its own Controller. With a layout arranged in this way traffic can be operated in exactly the same manner as on the up and down main lines of real railways. Two trains can then be run quite independently of one another so long as the two tracks are quite separate and are not joined by means of any rail connections, such as Crossover Points. These would immediately provide an electrical connection between the two circuits and render ineffective any efforts at separate control. When Crossover Points are required it is necessary to arrange an insulating gap in the third rail of that portion of track connecting the up and the down line. Crossover Points arranged thus can be obtained to special order at the ordinary prices. With separate control for the trains one of them can run slowly and stop at intermediate stations while the other speeds on its way as a main line express, and so on.

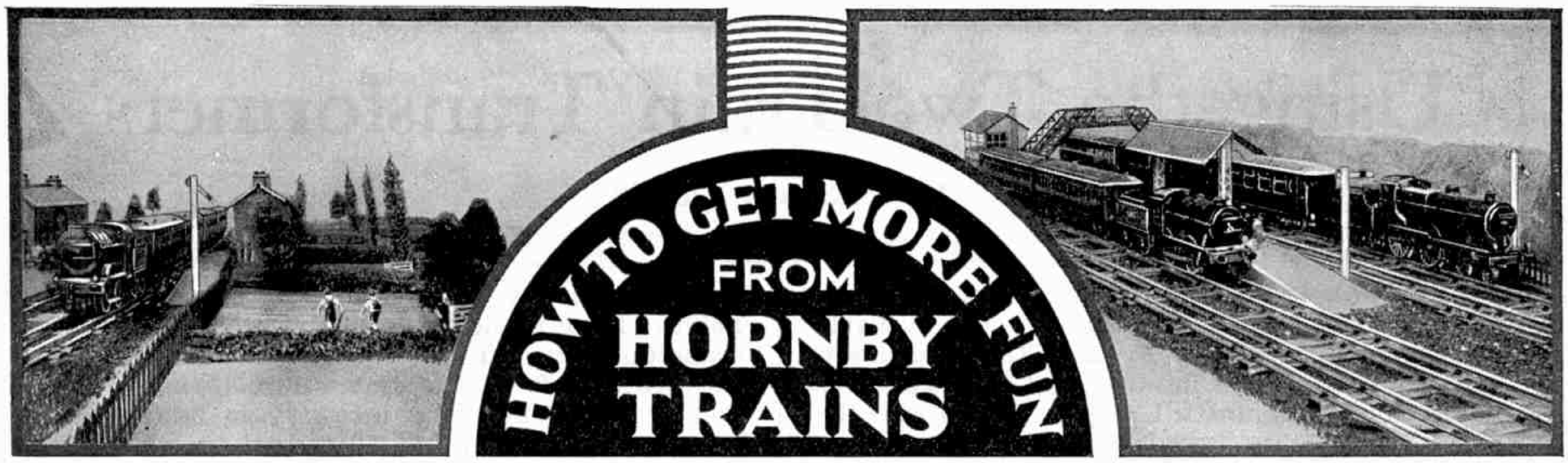
Connections from the Transformer to the two Controllers and the track are arranged as shown in the lower illustration on this page. Each track has a Terminal Connecting Plate and to the fuse terminal on each of these is brought a lead from a Resistance Controller. The two Controllers are wired to one terminal of the Transformer. The other Transformer terminal is wired to the remaining terminal on either Terminal Connecting Plate.



This illustration shows the method of connecting a T22M or T26M Transformer to Hornby Electric Double Track, when two trains are to be operated, one on each track.

All owners of Hornby Electric Railways are aware of the importance of the safety fuse incorporated on the Terminal Connecting Plates TCP20 and TCP6, and of the necessity of using only the correct gauge of fuse wire. On a 20-volt or 6-volt system with two trains running at the same time on the same track, the fuse should consist of No. 41 S.W.G. Tinned Copper Wire. When the two trains are on two separate tracks each of these tracks becomes a separate circuit, 20-volt or 6-volt as the case may be, each with a fuse on its own Terminal Connecting Plate. Each fuse on a 20-volt railway arranged in this way should consist of No. 32 S.W.G. Lead Wire. For a similar 6-volt railway No. 24 S.W.G. Lead Wire is correct.

The renewal of the fuse wire each time a short circuit occurs is apt to prove troublesome. This can be avoided when two trains are being run on two separate tracks by the use of two Hornby Automatic Circuit Breakers, one connected between each Resistance Controller and its respective track. The Circuit Breaker is not suitable for use where both trains are on one track.

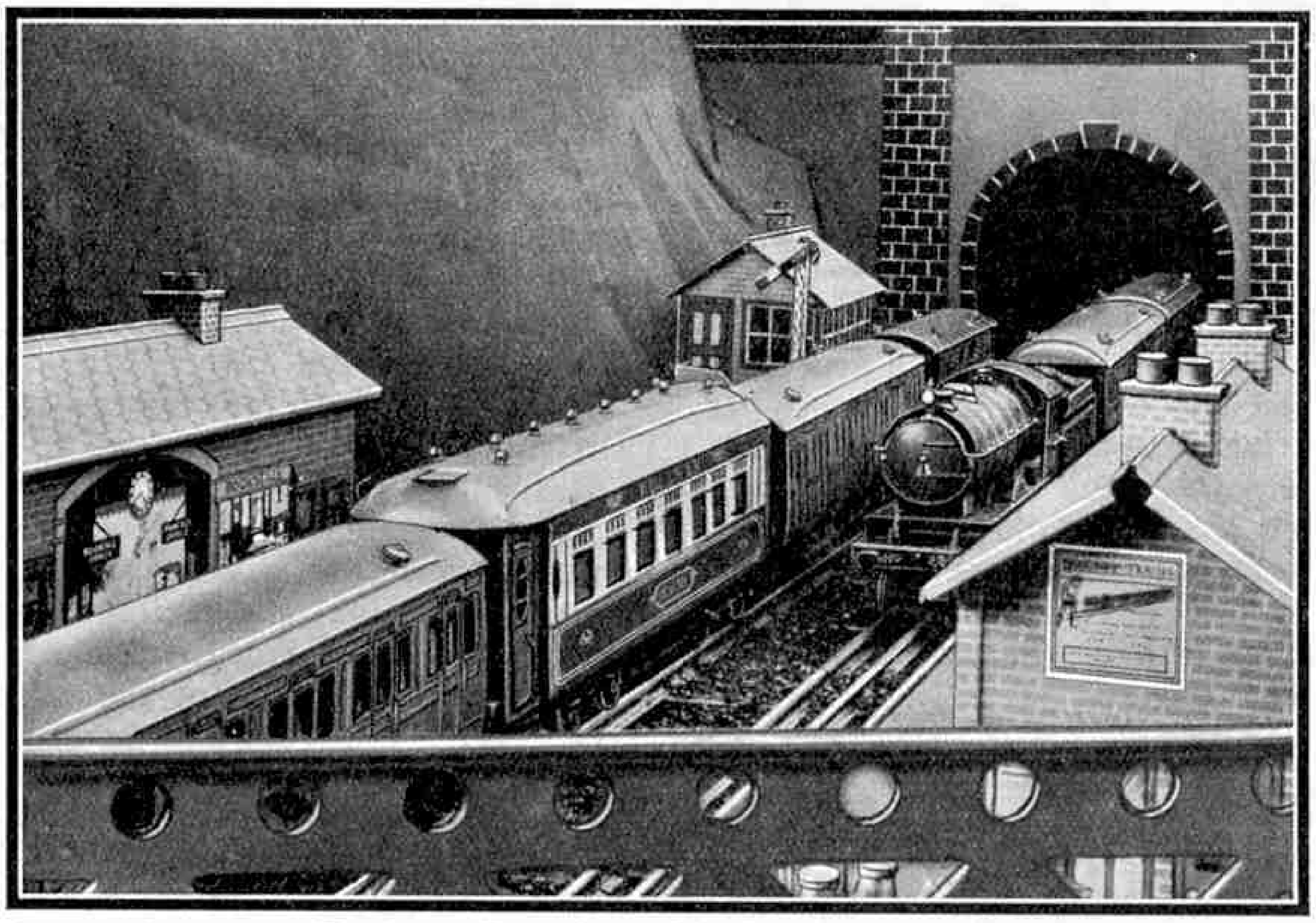


HOW TO GET MORE FUN FROM HORNBY TRAINS

SOME ELECTRIC RAILWAY SCHEMES

CONSIDERABLE attention is being given at the present time to railway electrification schemes and it is possible that in the near future we shall see some extensive developments. For this reason, and in view also of the increasing popularity of Hornby electric railways, it will be interesting to readers if we consider in this article the operation of miniature electric services.

It is chiefly on suburban work that electric trains have been employed in this country, although we must not forget the Brighton and Eastbourne electrification of the S.R., now complete, and the Portsmouth scheme now in progress; there is also the proposed electrification of the L.N.E.R. Sheffield to Manchester main line. The mileage of electrified track in this country is still comparatively small, but there is a considerable variety in the systems and equipment in use. It is not possible to represent them all by means of the components of the Hornby Series, but by variations in stock and in train make-up some interesting schemes can be developed.



An interesting scene on a Hornby joint Metropolitan and L.N.E.R. system. The Metropolitan train, including a Pullman Coach, is about to enter the tunnel, from which the L.N.E.R. train is emerging.

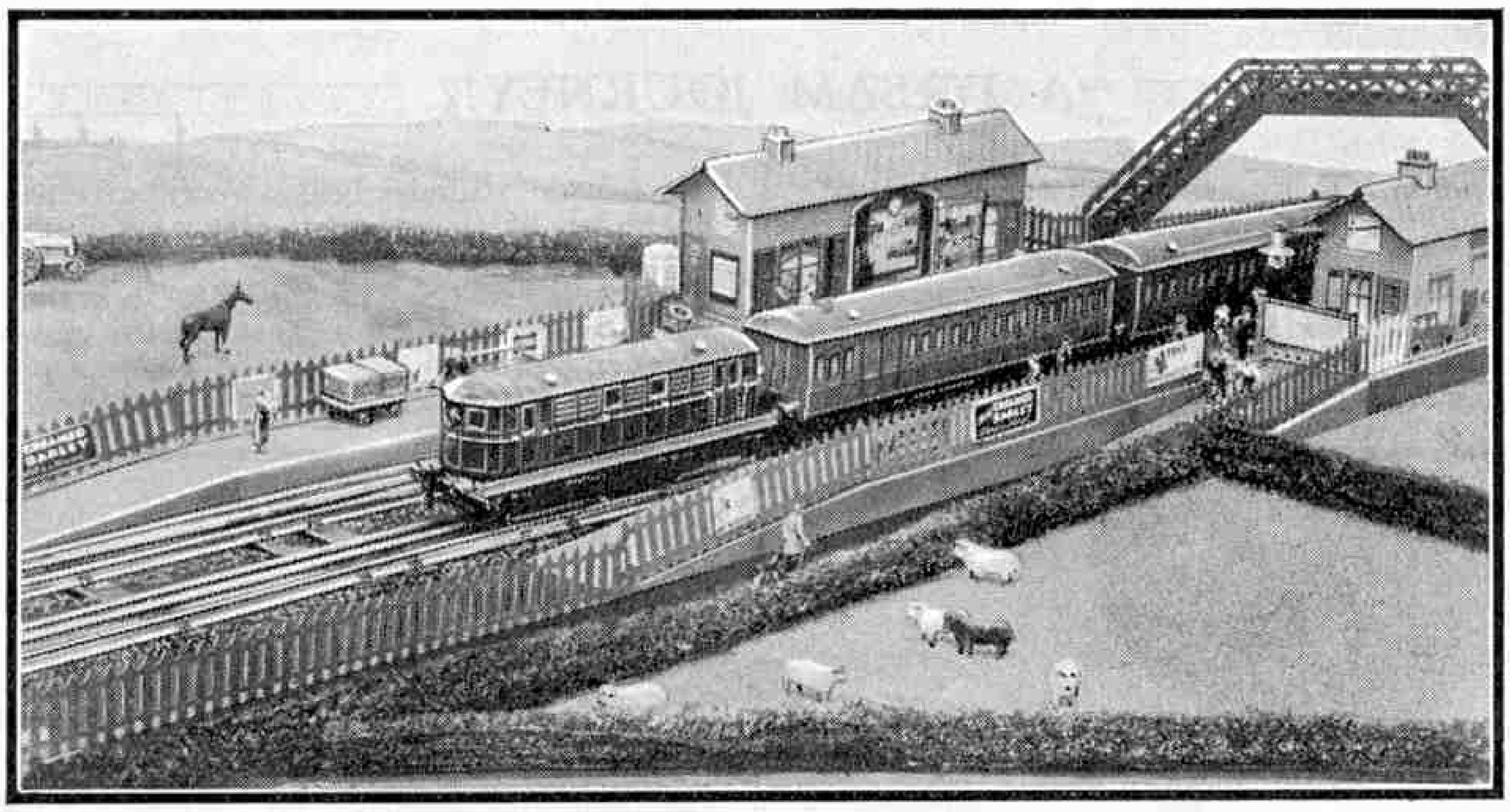
The oldest electric members of the Hornby Series are the familiar Metropolitan components, and good use can be made of them in the operation of a suburban service in miniature. The formerly independent Metropolitan Railway is now part of the London Transport organisation, and the term Metropolitan Line is used to distinguish this particular section of the system. Unlike other British suburban electrification systems, the Metropolitan Line uses separate electric locomotives for the haulage of some of its trains. These are the fast business services connecting the country districts with the City, which are composed of ordinary coaches and are steam-hauled over a part of their journeys. Thus separate electric locomotives are necessary to work these trains over the electrified length of their journeys up and down. These engines are used to a certain extent in freight services also.

The Hornby representative of this interesting type of locomotive can thus be employed on passenger or on goods trains as necessary. This Locomotive follows the characteristic outline of the real engines and it incorporates a great deal of realistic detail. The Hornby Metropolitan Coaches are of the normal compartment type, and each Metropolitan Set contains one first-class and one brake-third vehicle. Those included in the Electric Set are fitted for electric lighting, and this feature, in conjunction with the headlights of the Locomotive, gives the whole train an interesting and realistic appearance. The complete train forms a smart unit for suburban services, and additional interest will be given to operations if the change-over from the electric type to the steam type locomotive, and vice versa, is carried out regularly at a suitable station on the line.

A feature that is of special interest is the incorporation of a Pullman car in certain of the through Metropolitan trains. The reproduction of this practice in miniature will add considerably to the fascination of Metropolitan train operation. The inclusion of a Hornby No. 2, or No. 2 Special Pullman Coach in the make-up of a Metropolitan train gives an air of distinction to the service selected.

In addition to these electric trains requiring the use of separate electric locomotives, numerous electric trains of the motor-coach or multiple-unit type are operated on the Metropolitan Line. Compartment stock is used more particularly for those trains working into London over the surface electrified lines. Hornby Metropolitan Coaches are exactly what is required for these trains. Centre-gangway stock also is found, but the true home for these vehicles is in the London underground area. For such vehicles the nearest Hornby substitute is found in L.N.E.R. Saloon Coaches, which resemble Metropolitan stock in their colouring, and are of course of the end-vestibule centre-corridor type. The problem that remains is that of motive power, as electric motor-coach vehicles are not yet included in the Hornby Series.

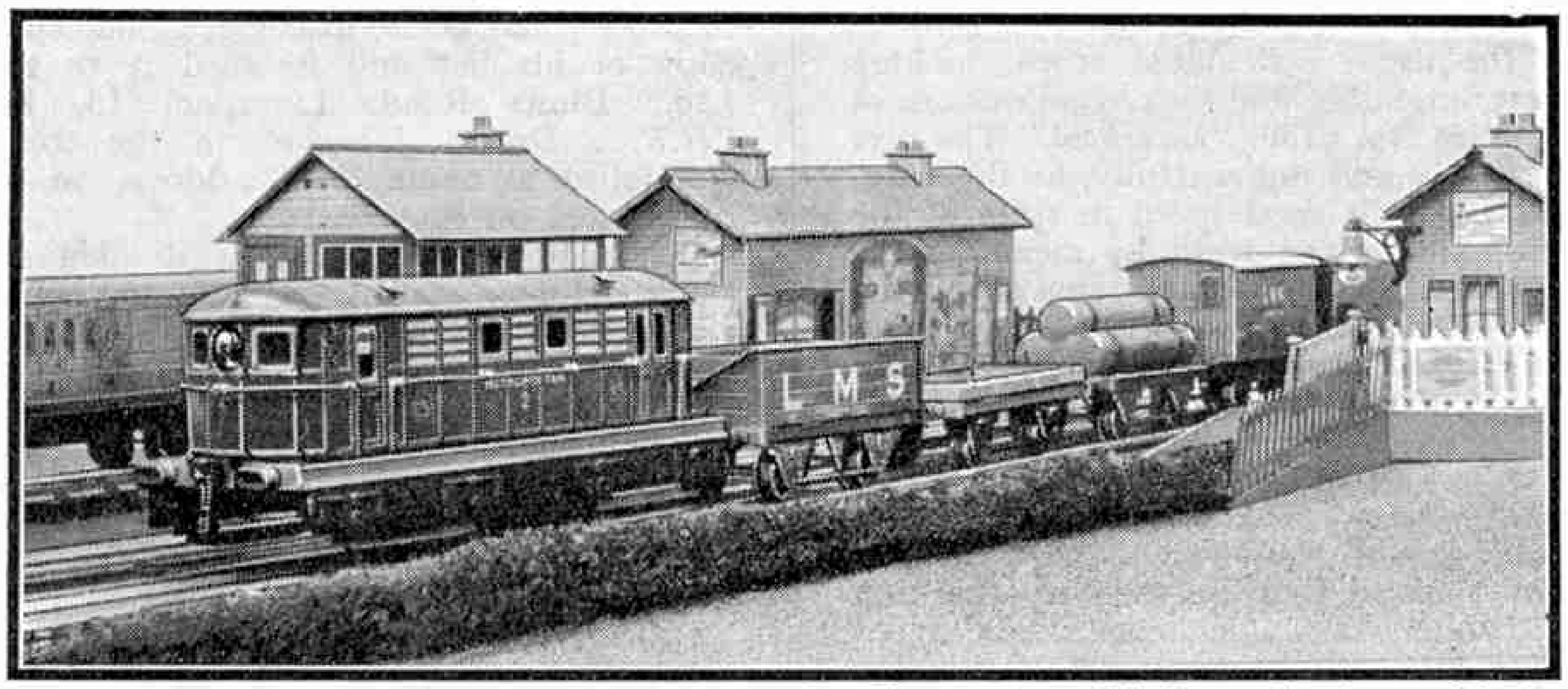
Certain readers have therefore hit on the scheme of including in the centre of a formation of coaches of suitable type a Metropolitan electric locomotive. Actually the presence of the electric engine in the centre is not particularly noticeable, especially if brake-third coaches form the leading and trailing vehicles. These incorporate guard's and luggage accommodation at one end that can be taken to represent the driving and the motor compartments respectively of real stock.



The Hornby E36 Metropolitan Locomotive hauling a passenger train composed of appropriate compartment stock. This illustration gives a good idea of the realistic design of the Hornby Metropolitan components.

Similar arrangements as suggested for the Metropolitan can be adopted for the representation in miniature of the multiple-unit trains of other electrified lines. The stock employed will of course be varied according to the company and route represented. The well-known suburban services of the S.R. for instance could be run with Hornby No. 2 Coaches in S.R. colours and an LE120, or LE220, Locomotive in the centre of the train.

Again, L.M.S.R. No. 2 Coaches and an LE120 or LE220 Locomotive could be used to reproduce the trains running on the electric services of that Company. Some of the L.M.S.R. electric trains in the London suburban area, and those on the Liverpool and Southport line, are of the centre-corridor type with end doors. For the stock composing these, as for the Metropolitan trains of this kind, the nearest vehicle in the Hornby Series is the No. 2 Saloon Coach, but this time we shall require it in L.M.S.R. colours. For the Liverpool and Ormskirk trains, compartment stock as in the London area is chiefly used.



Freight operation by means of a Hornby Metropolitan engine. The prototype of this Locomotive is one of the few designs of electric locomotives operating on the railways of Great Britain.

Another of Liverpool's electric railways is the Mersey system linking both sides of the river of that name by means of the first tunnel beneath it. It has come prominently into notice recently in connection with the scheme for the electrification of the Wirral line of the L.M.S.R. Connection is made between the Mersey Railway and the old Wirral system at Birkenhead Park, so that L.M.S.R. steam-type trains can be run in miniature in conjunction with an electric service representing the Mersey trains. The latest Mersey coaches are not unlike Hornby No. 2 Saloons in general appearance, and they are painted in a similar shade of red to the L.M.S.R. vehicles. Multiple-unit trains are used, and a miniature Mersey system should certainly include some "underground" sections.

Similarly we could operate trains representing the Manchester and Altrincham joint electric services of the L.M.S.R. and L.N.E.R. Overhead wire equipment is used so that the pantographs on the LE120 and LE220 Locomotives will not be out of place. In view of their joint character these trains are finished in a manner very similar to that of S.R. stock. In miniature therefore S.R. vehicles could be used, without appearing noticeably inaccurate.

A great advantage of the multiple-unit type of formation is its handiness for working in and out of terminal stations. Frequently in miniature there is not a great deal of space to spare in terminals, so that the "running-round" facilities that are required by separate locomotives often cannot be provided. Thus unless another locomotive is available to draw the train out of the terminus, a considerable amount of manœuvring may be necessary to get the arriving engine on to the other end of the train ready for departure. The motor-coach type of train thus scores with its ability to run either way at will. With an LE220 Locomotive providing the motive power, as suggested for trains of this kind, the automatic reversing properties of this engine avoid any necessity for handling the train either in its arrival or departure at a terminus. Thus the miniature "multiple-unit" train can come in and go out as smoothly and with as little fuss as do the real ones. There is in fact one movement less involved in miniature, as the "motorman" does not have to walk from one end of the train to the other!

In addition to the representation of such services as are now operated electrically the electrification schemes at present in progress or in course of preparation suggest the anticipation of future working. The L.M.S.R. and Mersey Wirral scheme has already been mentioned. The L.N.E.R. main line from Sheffield to Manchester, when electrified, will employ separate locomotives for passenger and freight traffic. Overhead equipment is to be used, so that the LE120 and LE220 types with their dummy pantograph gear will be suitable units for a Hornby Electric Railway laid down on these lines. No doubt too in course of time the use of electric locomotives for freight traffic, over lines already electrified, will be greatly increased.

Join the Hornby Railway Company and become eligible for the competitions announced on this page.

H.R.C. COMPETITION PAGE

Join the Hornby Railway Company and become eligible for the competitions announced on this page.

"A DREAM JOURNEY!"

In the programmes of most H.R.C. Branches talks on railway and other subjects form a popular part of the regular programme. There is little doubt that the members who give such talks spare no efforts to make their information as complete and as interesting as possible. A little while ago we heard from the hard-working Secretary of a certain Branch who had made a journey on a well-known express and carefully noted as much as he could in order to describe the run at the next Branch meeting. His enthusiasm for the subject was such that one night he dreamt that he had given a talk, but it was all hopelessly mixed up! In a letter to Headquarters he described the actual journey, also the dream-journey, and it was interesting to see how they varied from one another.

We decided that this dream journey would make a good subject for an Errors Contest of the kind so popular with readers, and therefore reproduce the story exactly as told by our correspondent.

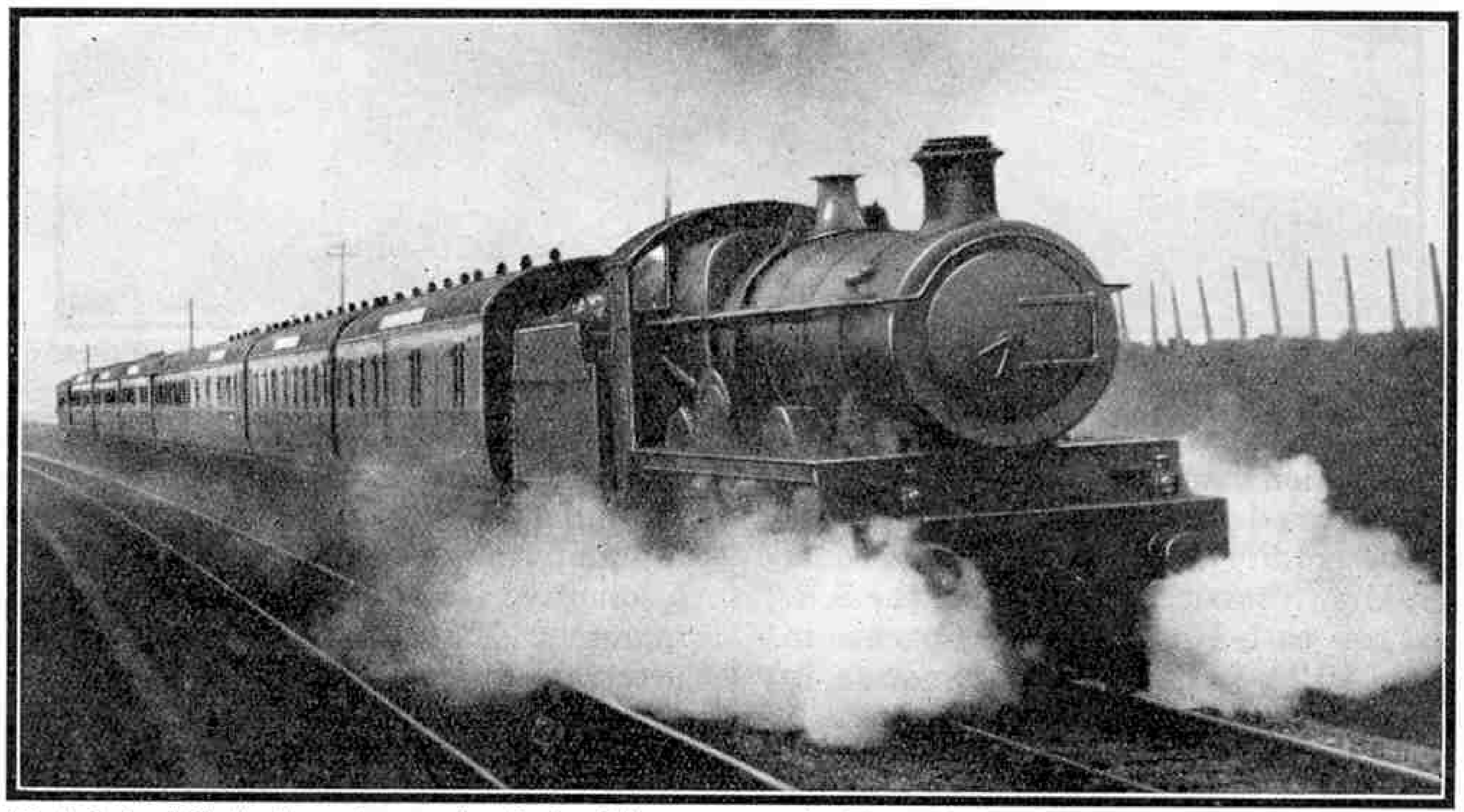
"On the day I went to Seaton I hurried to Waterloo to catch the *"Cornishman,"* getting aboard the last coach of the train that formed the slip portion to be detached at Taunton. The vehicles composing the train were the usual articulated stock, looking decidedly smart in their aluminium finish, and the engine was one of the 4–6–2 "Football Club" series No. 6130, *"Liverpool."* The first part of the journey passed rapidly and uneventfully, as the automatic signals helped us to keep up a good speed in spite of the prevailing fog. I decided to 'explore' the train by means of the corridor running throughout and in the next coach came across the guard, who was preparing to detach the slip portion as we were nearing Westbury. I noticed carefully how he did it, pulling a lever in his van to release the slip coupling and gradually the detached coach eased away from us.

"Continuing through the train I entered the Pullman buffet car, where I dined, and afterwards was fortunate to be able to look into the Travelling Post Office van at the head of the train. Returning to my compartment I found that we were approaching Stephenson's tubular bridge over the Tamar. I noted the industrial character of the district. We passed several heavy coal trains coming up from South Wales, the freights of many of them no doubt being destined for the factories in the neighbourhood through which we were passing. Towards the end of the run the average speed maintained was not so high as previously, owing to the mountainous nature of the country there passed through.

"Finally we drew up at Queen Street station, Exeter, which is jointly owned by the L.N.E.R. I stayed on the platform for some little time watching hump shunting being carried out in the mechanised yard, which is opposite the station and which is fully equipped with modern rail brakes. Eventually I reached my destination by means of the connecting road service and thus ended a most interesting day."

Readers will see that here is a splendid opportunity for discovering mistakes. Some of the errors are well hidden and liable to pass unnoticed, so that the account should be read very carefully. When each competitor is satisfied that every mistake has been discovered, he should make out a neat copy of his list and forward it to Headquarters at Meccano Ltd., Binns Road, Liverpool 13, in an envelope marked *"H.R.C. Dream Journey"* in the top left hand corner. The competitor's name and address and H.R.C. number must be marked on each entry.

The competition will be divided as usual into two sections, Home and Overseas. In each of these the sender whose list contains the largest number of errors will be offered a choice of any products manufactured by Meccano Ltd., to the value of 21/–. To the two entries that are judged next in order of merit will be awarded similar prizes to the value of 15/– and 10/6 respectively. A number of consolation prizes will be awarded. The closing dates are 30th June for Home competitors, and 30th September for those competing in the Overseas Section.



The train in which the dream-journey described on this page was made. The engine is a G.W.R. two-cylinder 4–6–0 No. 2937 "Clevedon Court," of the "Saint" class.

Railway Photographic Contest

This month we announce the third of the series of Railway Photographic Contests commenced in April. There are no restrictions with regard to the subject chosen, but the actual exposure must have been made by the competitor.

Prizes of Hornby Train or Meccano goods to the value of 21/–, 15/– and 10/6 respectively will be awarded in each Section, Home and Overseas. Envelopes containing entries should be marked *"H.R.C. June Photographic Contest,"* and posted to reach Meccano Ltd., Binns Road, Liverpool 13, before 30th June. Overseas closing date, 30th September.

February "Concealed Stations" Contest Solution

Canonbury (L.M.S.R.), Wilmcote (G.W.R.), Essendine (L.N.E.R.), Deganwy (L.M.S.R.), Petrockstowe (S.R.), Woofferton (G.W.R.), Mytholmroyd (L.M.S.R.), Ulleskelf (L.N.E.R.), Oxshott (S.R.), Hoylake (L.M.S.R.), Sarnau (G.W.R.), Yeoford (S.R.), Presteign (G.W.R.), Yaxham (L.N.E.R.), Bulford (S.R.), Hednesford (L.M.S.R.), Preesgweene (G.W.R.), Sholing (S.R.), Galashiels (L.N.E.R.), Leebotwood (L.M.S.R.), Gosberton (L.N.E.R.), Holsworthy (S.R.), Minffordd (G.W.R.), Cullercoats (L.N.E.R.).

COMPETITION RESULTS

HOME

April "Signalling Contest."—First: J. R. Sleightholme (17091), York. Second: K. E. Milburn (26029), Chingford, London, E.4. Third: D. S. Dunsmore (33072), Sutton, Surrey. Consolation Prizes: W. Pollard (45922), Datchet, Nr. Slough, Bucks.; B. Gerrard (22476), Thornton Heath, Surrey; J. F. Cockshutt (14178), Streatham Park, London, S.W.16; R. Harvey (38560), Mundesley, Norfolk; C. W. Atkin (13233), West Kirby, Cheshire; J. C. Button (10335), Crewe, Cheshire; R. B. Williams (35085), Pelaw, Co. Durham; R. S. Dench (28187), Hall Green, Birmingham, 11; J. L. Stevenson (22346), Edinburgh 11.

April "Railway Photo Contest."—First: V. L. Breeze (2134), Kingston, Lewes, Sussex. Second: C. Spencer (44179), Sheffield, 11. Third: F. Lowrey (47672), Harrogate, Yorks. Consolation Prizes: D. F. Forbes (14092), Leith, Edinburgh 6; E. C. Morgan (10735), Wandsworth Common, London, S.W.18.

Branch News

New Southgate.—Various competitions were a popular feature at recent meetings, members having to guess the names of different stations from clues read out to them. A visit was paid to the Exhibition of the Model Railway Club at Central Hall, Westminster, and was greatly enjoyed, as the members gained many new ideas for improving the Branch layout. Secretary: A. R. Wardle, 25, Limes Avenue, New Southgate, London, N.11.

Waterloo (Dublin).—Several successful track meetings have been held at which timetable operations have proceeded normally. A special feature was made of holiday traffic working for the period of Easter. Certain trains were cancelled, but additional expresses were brought into use temporarily. These workings included special engine movements and both formed the subject of a "Special Notice" circulated among members. It has since been decided to renumber all the locomotives belonging to the Branch after various engines of the G.S.R. of Ireland. The number plates are to be obtained from the automatic nameplate machines that are found on railway stations. Secretary: S. B. Carse, 38, Oakley Road, Ranelagh, Dublin.

Chorlton-cum-Hardy.—An interesting visit was paid recently to the Manchester Central Fire Station. This visit was followed by a tea and a very successful Social. At track meetings timetable working has proved to be very popular, and good running was made on the first trip of a new express known as *"The Norseman."* It is intended to make timetable operations a standard feature and definite programmes are worked to at each regular Branch meeting. It is proposed to hold a small Exhibition in the near future. Secretary: G. H. Gill, 54, Highfield Road, Chorlton-cum-Hardy, Nr. Manchester.

St. Stephen's (Saltash).—Work has been in progress on a new track and satisfactory tests have been carried out over those sections so far completed. In order to give variety to the programme, the first meeting every other month is to be devoted to games. A Table Tennis league is run among Branch members and matches with other organisations are occasionally arranged. A visit has been paid to the Branch by members of the Plymouth Meccano Club, and a combined cycle run and ramble has been one of the most successful recent Branch events. Secretary: B. Braund, 9, Homer Park, Saltash.

Folkestone.—Shunting operations and goods working generally have been features of recent meetings. Some notable fast freight services are now operated regularly. The real Folkestone services from London are the prototypes on which the passenger operations on the Branch layout are modelled. It has been decided to include a miniature Folkestone Harbour in the layout and work has been started. A model steamer to stand at the quayside is now complete. New signals have been installed on the system and the Branch room itself has been repainted. Special arrangements were made for the Easter holiday traffic and these were successfully worked in an interesting manner. Secretary: F. E. Saunders, 79 Dover Road, Folkestone.

Some members of the Addiscombe H.R.C. Branch No. 280. Chairman, Mr. C. Chandler. Secretary, G. Chandler. This Branch was incorporated in 1934 and has progressed rapidly. A permanent track is available for train operations and a Branch Library also is maintained.

Claremont (Nottingham).—At a recent track meeting tests were made of the comparative speeds and hauling powers of the various locomotives. The practice of slipping coaches at various wayside stations has been adopted with success and is a popular feature. Members visited and greatly enjoyed an L.N.E.R. Exhibition of locomotives and rolling stock at Nottingham, and were keenly interested in the various aspects of railway working that were explained to them. Secretary: R. Ingham, 132, Mansfield Road, Nottingham.

Northampton.—The programme of this Branch continues to show a pleasing variety, which probably accounts in large part for the satisfactory attendances at meetings. Several Games Nights have been held. A shunting competition and timetable working have proved attractive. On the first anniversary of the foundation of the Branch, the first timetable ever arranged for Branch use was worked through, and comparison between this and present operating arrangements was of great interest. A series of lantern lectures is being arranged. Secretary: D. K. Adams, 8, Cedar Road, Northampton.

Elmside (Exeter).—Recent track meetings have shown a considerable improvement in train working, as new members have become used to Branch operating methods. A section for members interested in radio has been commenced. No special future arrangements have been planned, and the normal programme will be continued. Secretary: T. W. A. Smith, 98, Ladysmith Road, Exeter.

Islington.—An interesting talk has been given on the *"Post Office Tube Railway."* Two Lantern Lectures were particularly well enjoyed, one dealing with *"The Railway Museum"* (L.N.E.R.) and the other with *"Britain's Largest Railway"* (L.M.S.R.). Train working according to timetable has proceeded in the usual manner and attention has also been given to fretwork, games and other activities. Secretary: S. Gardner, 3, Tiverton House, Pleasant Place, Canonbury, London, N.

Rutherglen (Glasgow).—An interesting operation recently has been the taking down of the track and the overhaul of the baseboard. Considerable attention also has been given to repairs required by various locomotives, with which tests for speed and hauling power were then carried out. A new track is being laid down different in design from the former one, and train working arrangements for it are under discussion. Various competitions and a regular programme of games are being arranged for the near future. Secretary: R. G. Langmuir, 11, Afton Street, Shawlands, Glasgow, S.1.

AUSTRALIA

Sydney.—Various developments on the Branch layout have been taking place, and a new line 56 ft. long has been opened. It is single throughout, but has two passing loops at intermediate stations. An interesting talk was given at a recent meeting by Mr. T. Watson on *"The Railways of Tasmania."* Various excursions in conjunction with the local Railway Touring Club have been held, including visits to Kiama, Toronto and to Austinmer on the South coast. The Austinmer trip was particularly enjoyed and involved the special naming of the excursion train "The Meccano Club Express." This train will be used for future Branch excursions. Secretary: T. Watson Box 1749JJ, G.P.O., Sydney, Australia.

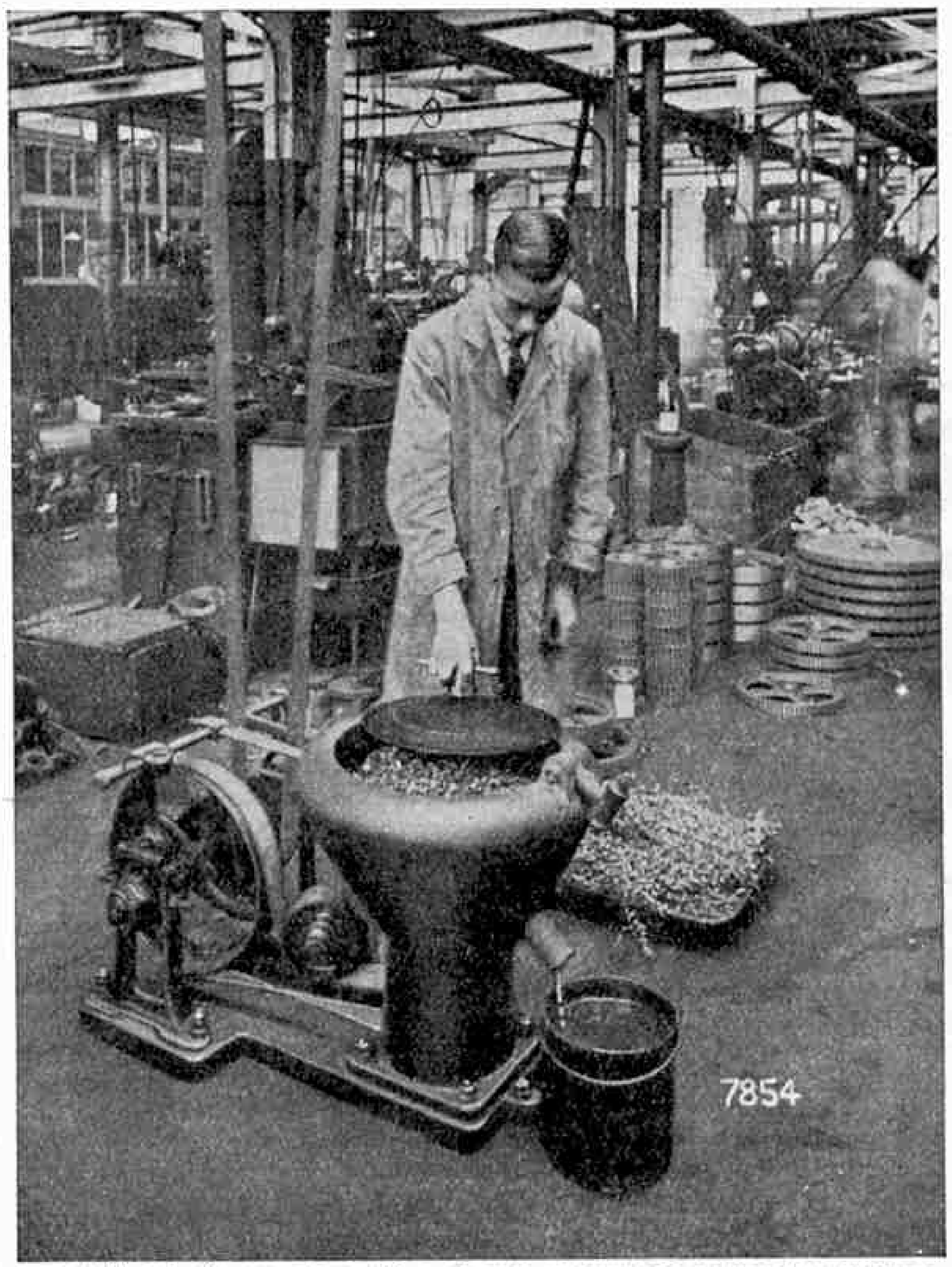
Branches Recently Incorporated

304. Glenpaston (Stamford Hill)—V. L. Passer, 5, Moundfield Road, Clapton Common, London, N.16.
305. St. Andrew's (Montpelier)—K. W. J. Bartlett, 33, Bath Buildings, Montpelier, Bristol, 6.

Reclaiming Oil from Waste Metal

Centrifugal Separators

THE power absorbed in driving a machine is indirectly converted into heat through friction. In machines employing cutting tools, both the tools and the materials dealt with become hot, and if the rise in temperature is not checked the former lose their edges too quickly and the latter depreciate in quality and value. These disadvantages are avoided by using a coolant, or cooling liquid, that also is of value in giving a smooth and finished surface to the work and lubricating the cutting edge.



A centrifugal oil separator with a charge of turnings in the rotating pan. Recovered oil is flowing from the outer casing. Photograph by courtesy of Manlove, Alliott and Co. Ltd., Nottingham.

There are several liquids that can be employed to prevent a rise in temperature during machining operations, and oil is one of the most popular of these for certain classes of work. For the purpose of mass production, parts machined at high speed are literally bathed in oil, and the turnings and swarf are washed away into a sump. The oil is allowed to drain into a reservoir below the machine, but much of it is held in surface tension with the metal, the amount retained depending on the extent of surface exposed. The waste material formed in these operations consists of pieces of very small dimensions, and its surface area is so great that it takes up a surprisingly large quantity of oil.

Automatic machinery must be kept working at full output, and requires lubricants of high quality for its cutting tools. The oil used is costly, and large quantities of it are required, especially in works where batteries of high-speed tools are kept continually at work. It is essential therefore that some means of recovering it from waste metal should be adopted, and it also is necessary to separate it from machined parts, especially if these are of brass or other non-ferrous metal, or are to be plated, varnished or lacquered.

Much of the oil used in work of this kind can be recovered from the work turned out, and also from cuttings, turnings and swarf, by ordinary drainage. Special methods must be employed in order to obtain the whole of the oil these retain, however, and centrifugal separators have been introduced for this purpose. A typical separator, designed and manufactured by Manlove, Alliott and Co. Ltd., Nottingham, is illustrated on this page. In it the material to be treated is whirled round at high speed, when centrifugal action causes the oil to fly outward into a collector of suitable form.

Inside the outer casing of the separator is a revolving pan consisting of a dished steel plate and having sloping sides. It is supported by a vertical driving shaft that extends upwards through it. The pan is charged with the oily material, but is not quite filled, because centrifugal force is greatest where the speed is highest, that is near the side of the pan, and the portion of the charge near the centre does not come under its influence to the same extent. The rotation of the charge tends to move the pieces of which it consists outward to the region where the effect is greatest.

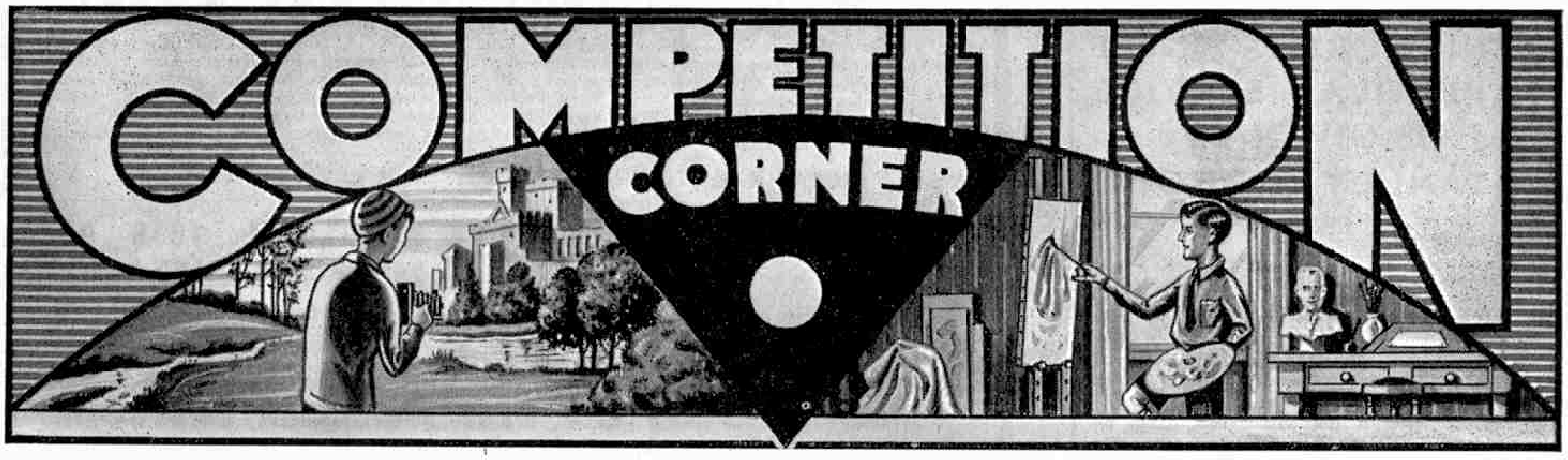
A few clean rags usually are laid on top of the metal parts before the cover is screwed on the pan. These act only as filters to prevent fine swarf from leaving the pan when the machine is in motion. If different small parts are to be treated, and the number of each of these is insufficient to warrant the use of the machine for each kind separately, they are made up into separate bundles wrapped in clean rags. The separator then deals with them as effectively as if they were loose. Small parts, such as screws, bolts and nuts also can be dealt with in this separator.

When the cover plate has been screwed on the machine is set in motion, revolving at a speed of about 1,600 r.p.m. Under the influence of the centrifugal force developed, the oil is flung outward and expelled through the very narrow space between the knurled edges of the bucket and its cover, and is collected inside the outer casing and allowed to drain away to a collector.

The machine can be provided with counter gear to enable it to be driven by a belt through a shaft, as shown in our illustration, or fitted with an electric motor. Very little power is required to drive it, and that need only be applied while getting up speed, after which the revolving pan can be allowed to free-wheel. The separator is brought to rest by means of a hand brake.

The machine is speedy and very effective. A trial with 15 lb. 13 oz. of turnings produced 1 lb. 10 oz. of recovered oil. In another test, a charge of 23 lb. 10 oz. of oily turnings and screwings taken directly from machines yielded 1 lb. 1 oz. of oil, and one of the same weight taken from a heap of waste material that had been standing for several days, during which oil drained from it, produced 12 oz. of oil.

In many cases it is found most convenient to instal several small machines in different parts of a workshop rather than a single large machine. Centrifugal machines of greater capacity are used in special cases, however. For example, separators in the works of the Hoffman Manufacturing Co. Ltd., Chelmsford, recover from 500 gals. to 1,000 gals. of oil per day from about nine tons of material.



COMPETITION CORNER

A NEW DOUBLETS CONTEST

The Doublets puzzles that we have set for our readers from time to time have proved consistently popular, and as it is now a considerable time since the last such contest, we are giving a fascinating new series this month.

For the benefit of new readers it must be explained that a Doublet consists of two given words, each containing the same number of letters. The puzzle requires one word to be changed to the other by placing connecting words between. The connecting words are known as links, and each link must differ from the preceding one by the alteration of only one letter. The test is to make the change in the smallest number of links.

To make the idea clear we give the following examples:

Store CORN in BARN
CORN - born - BARN
Face WIND from WEST
WIND - wend - went - WEST

In making the links only English words appearing in a standard dictionary may be used. Proper nouns, names of persons, places, etc., are not permitted. It is important to remember that the first solution arrived at is not necessarily the shortest. Competitors should go over their solutions carefully in search of short cuts that will eliminate overlapping links. Close study often reveals links that may be removed to improve the solution.

The Doublets to be solved in this competition are as follows:

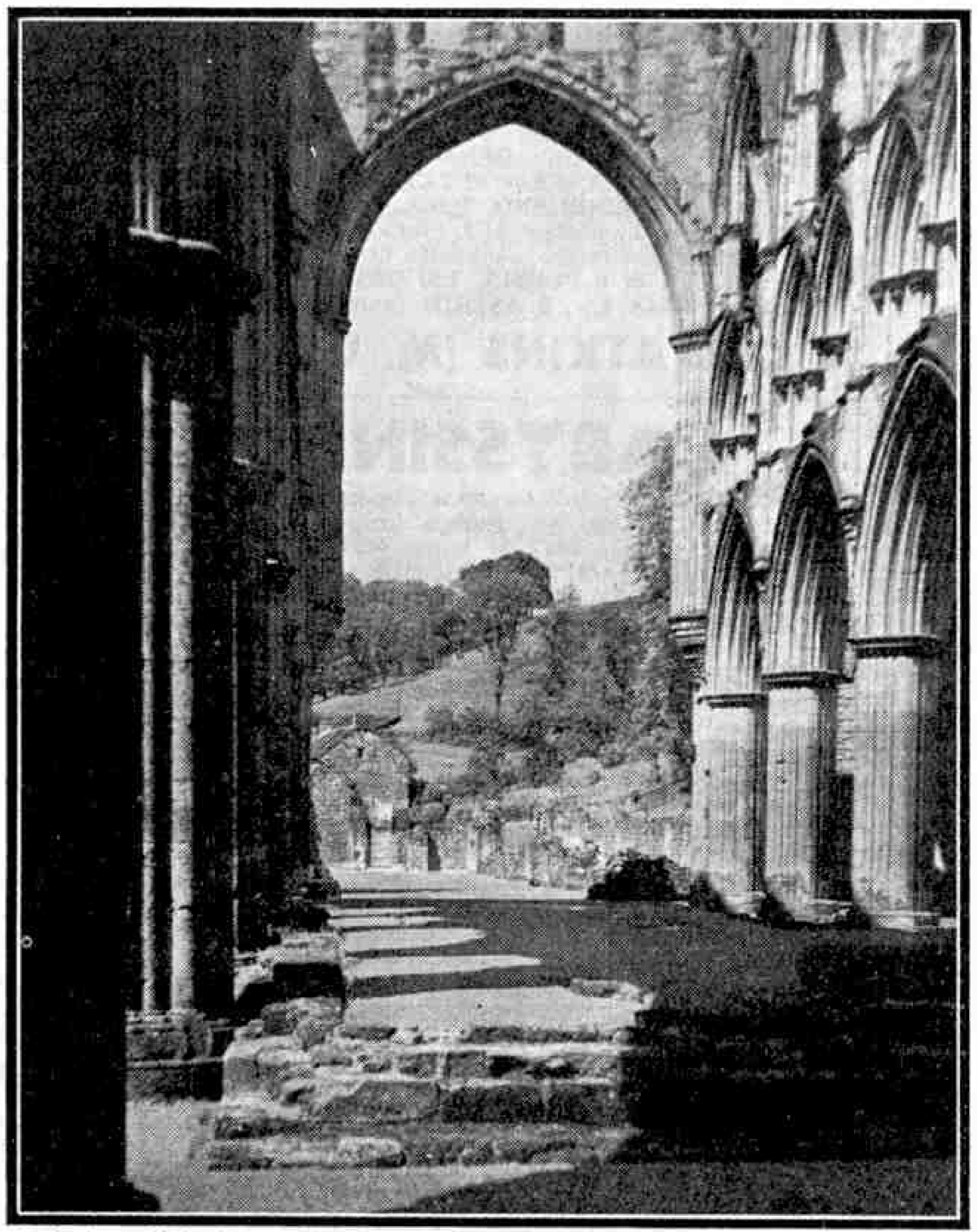
Fill TANK with FUEL
Secure BOAT with ROPE
Hook FISH from POND
Make PLUG of WOOD
Go SLOW down HILL
Cut ROSES from TREES
Change NOTES to COINS
Dye GREY to BLUE
Change GEARS with LEVER
Release BIRD from CAGE
Sail BOAT on LAKE
Level SOIL with RAKE

In judging the entries, the 12 doublets will be considered as one contest, and cash prizes of 21/-, 15/-, 10/6 and 5/- respectively will be awarded to the senders of the four solutions showing the lowest total of links used throughout. In the event of a tie for any of the prizes, preference will be given to the entry having the neatest or most novel arrangement.

It will be observed that the combination of the 12 doublets for judging purposes will ensure that a brilliant solution of one doublet will carry its full weight by offsetting to some extent failure to secure the shortest chain in another.

Entries should be addressed to "Doublets, Meccano Magazine, Binns Road, Liverpool 13" and sent to reach this office not later than 30th June. There will be a duplicate set of prizes reserved for entries from Overseas readers, whose entries must reach us not later than 30th September.

Entries must be written on one side of the paper only, and each sheet of paper used must bear the competitor's name and address. The total number of links used must be noted on the first sheet.



This beautiful view of Rievaulx Abbey, Yorkshire, secured First Prize in the April Photo Contest (A Section) for Eric H. Coles, Notting Hill Gate, London, W.11.

June Photo Contest

As we announced in our April issue, each month throughout the spring and summer we shall offer prizes for the best and most interesting photographs submitted.

Each month's competition will be divided into two groups, Home and Overseas, and these two groups will be divided into two sections, A for those aged 16 and over, B for those under 16. Cash prizes of 21/- and 10/6 will be awarded in each section.

The photographs may be of any subject and may be made with any make of camera, film or paper. Each photograph must bear the reader's name, age and address, and a title on its back.

Entries sent this month must be addressed "June Photo Contest, Meccano Magazine, Binns Road, Liverpool 13," and must arrive not later than 30th June. The Overseas closing date will be 30th September.

Competition Closing Dates

HOME	
June Doublets Contest	30th June
June Photo Contest	30th June
OVERSEAS	
Meccano Limericks	30th June
March Drawing Contest ...	30th June
Vocation Voting Contest ...	31st July
April Photo Contest	31st July
May Crossword Puzzle	31st August
May Photo Contest	31st August
June Doublets Contest	30th September
June Photo Contest	30th September

Watch the Closing Dates

COMPETITION RESULTS

HOME

April Photo Contest.—First Prizes: Section A, E. H. Coles (London, W.11); Section B, A. Large (Alloa). Second Prizes: Section A, S. Coleman (Sheffield); Section B, T. W. W. Jones (Brampton). Consolation Prize: R. Dace-Brown (London, S.W.2).

Vocation Voting Contest.—1. C. Weatherbed (Sheffield 9); 2. S. C. Stephenson (Croft, Nr. Leicester); 3. M. M. Reader (Birmingham 16); 4. H. Fairbairn (London N.15). Consolation Prizes: C. E. Wrayford (Moretonhampstead); F. Fendley (Parkstone); D. Gillies (Glasgow S.1); E. Gurney (Watford); T. Allen (Hull).

OVERSEAS

Cover Voting Contest.—1. J. C. Carter (Capetown). 2. N. Lefcoe (Quebec); 3. L. Chapman (Christchurch. N.Z.); 4. J. J. N. Carter (Capetown).

January Drawing Contest.—First Prizes: Section A. W. Jones (St. James); Section B, J. van Dalsen (Pretoria). Second Prizes: Section A, Carlo Cali Corleo (St. Julians, Malta); S. Adelagun (Ibadan, Nigeria).

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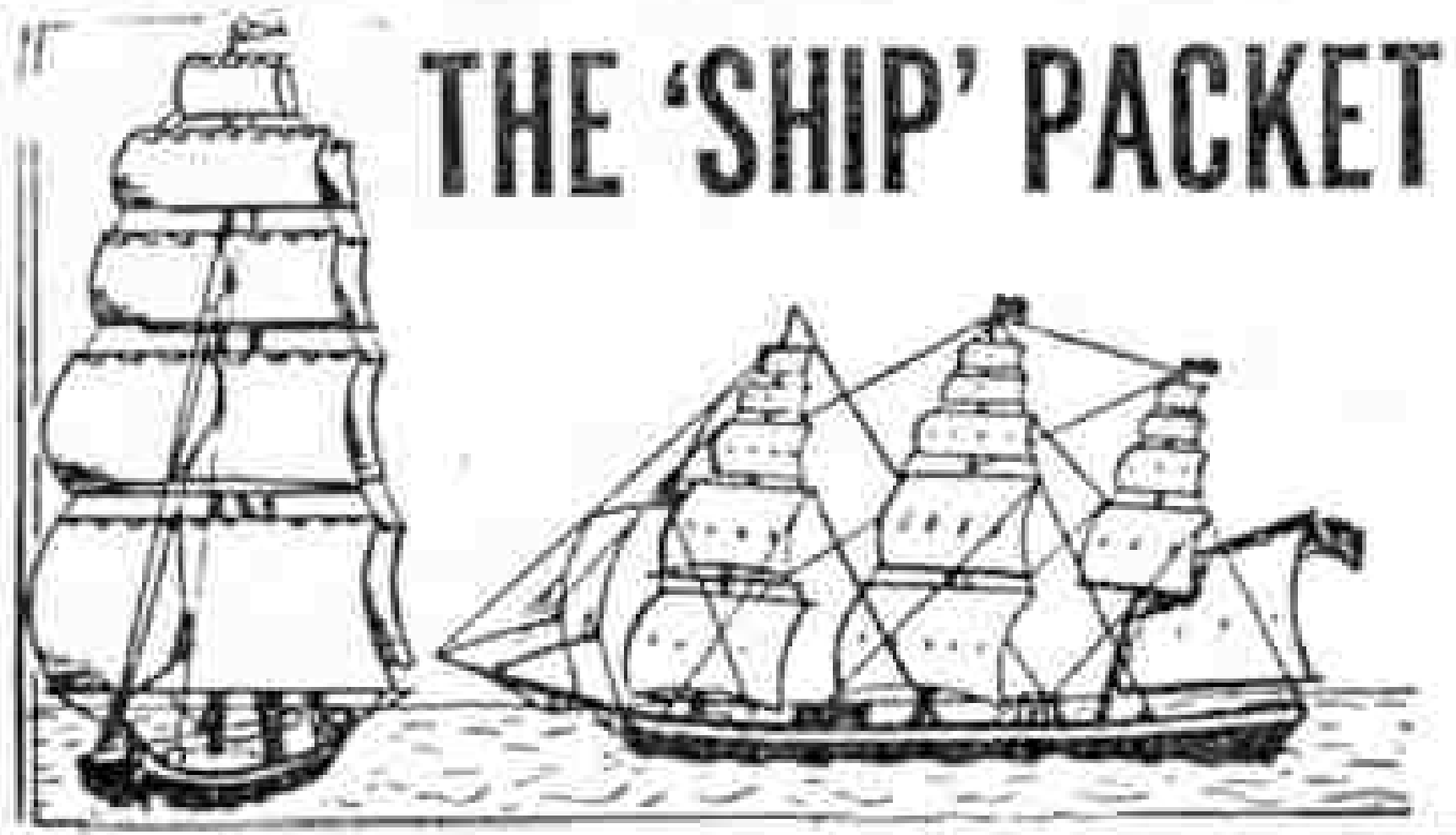

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Zoo in a Stamp Album—Ship Stamps—Watermarks—The Aerodrome—Single Country Collections—Olympic Games—Loose-Leaf Albums—Earthquake Stamps—Washing Day in the Stamp World—Three-cornered Market Place—British Empire Albums—Rare Stamps—Overprints and Surcharges—To Correspondents Abroad—Treasure Trove—Triangular Packets—Packets of British, French, Italian, Portuguese, Spanish and German Colonials—Building a Collection—West Indian Packets—Triangular Stamps—Philately Royal—Albums for Beginners—Penny Sets—English Men on Foreign Stamps—Emergency Papers—Shilling Sets—Advertising Stamps—Strip Pocket Books—Glossary—Stamp Tongs—Punctured Officials—etc., etc., etc. These are only a few Headings out of my **NEW SIXTY-PAGE BOOK,** which is **WELL ILLUSTRATED THROUGHOUT** and so full of the right sort of useful and interesting Philatelic information that **EVERY STAMP COLLECTOR MUST HAVE THIS BOOK,** FREE and POST FREE from

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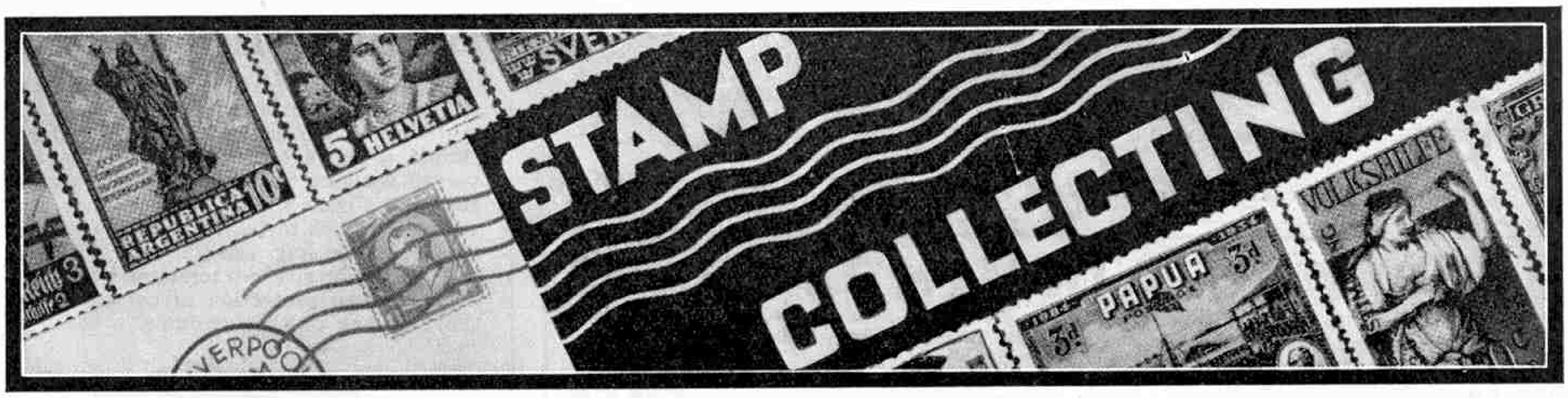
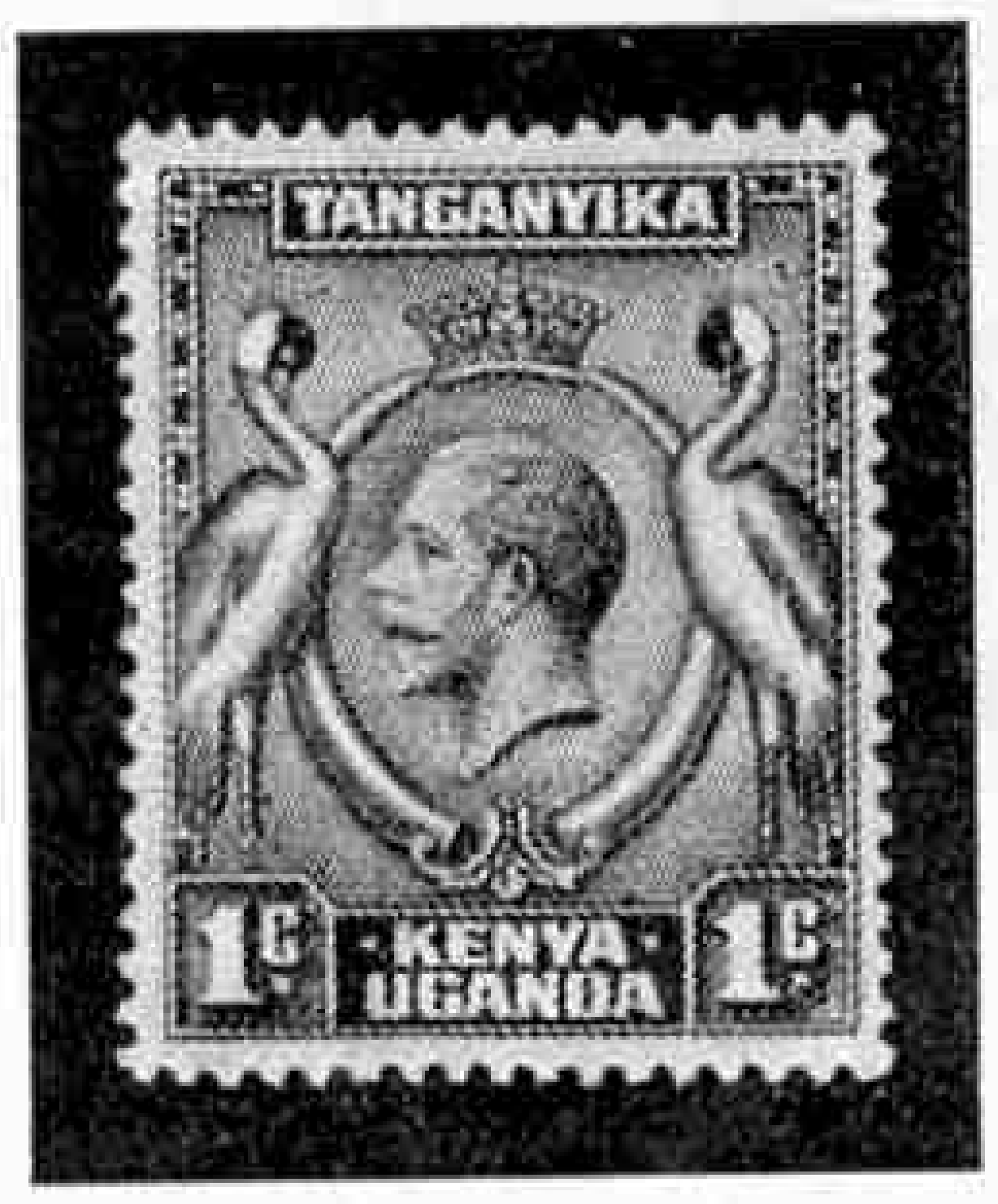


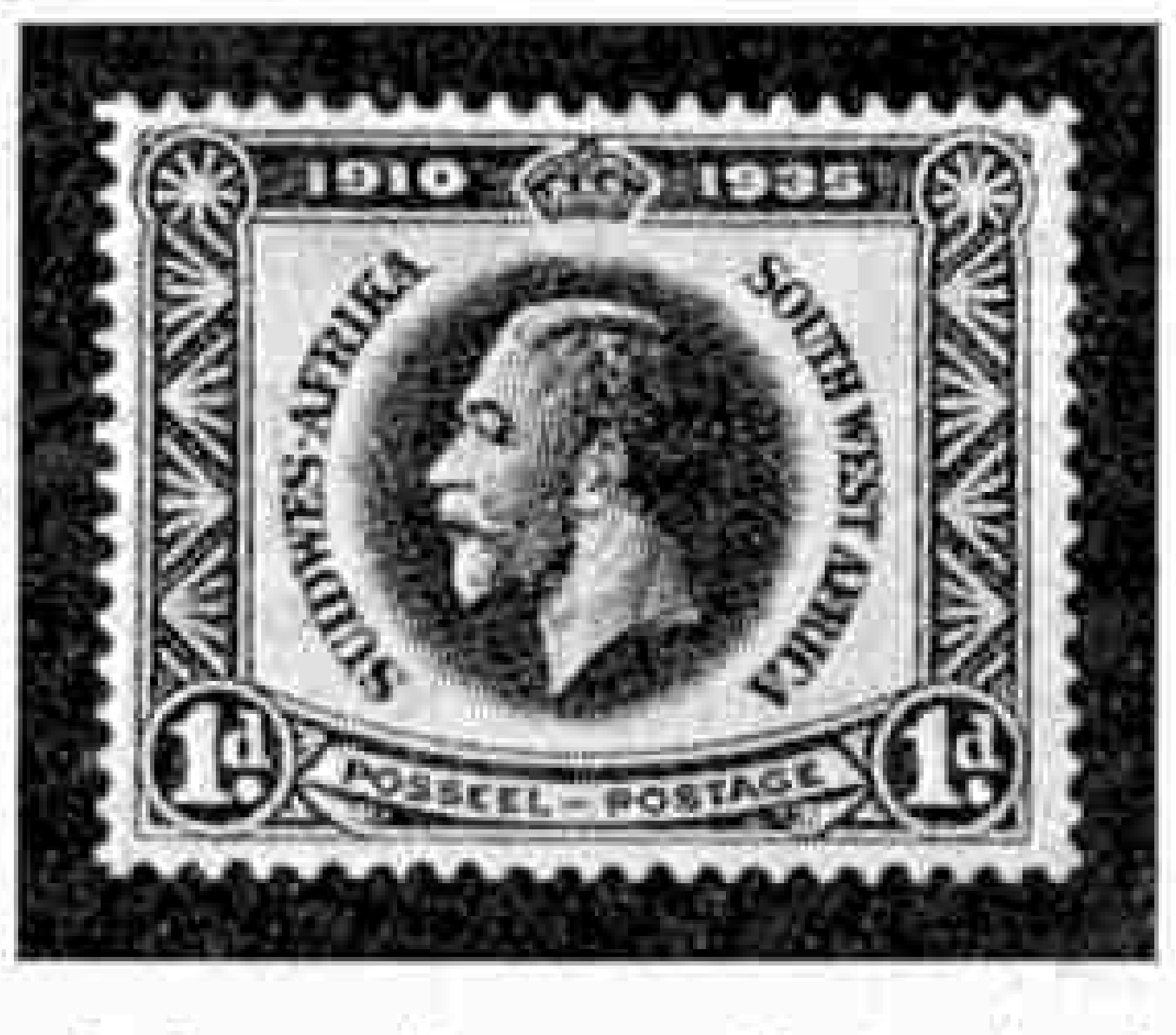
SUMMER STAMP COLLECTING

MANY boys at this season of the year, when the long hours of daylight make it possible to get out into the open in the evening, are tempted to tuck their albums and stamp mounts away into a drawer and forget about them until winter comes again. We confess to a little sympathy with their object. Sunshine is given to us to be enjoyed and no active person desires to be indoors when he can be out and about in the open.

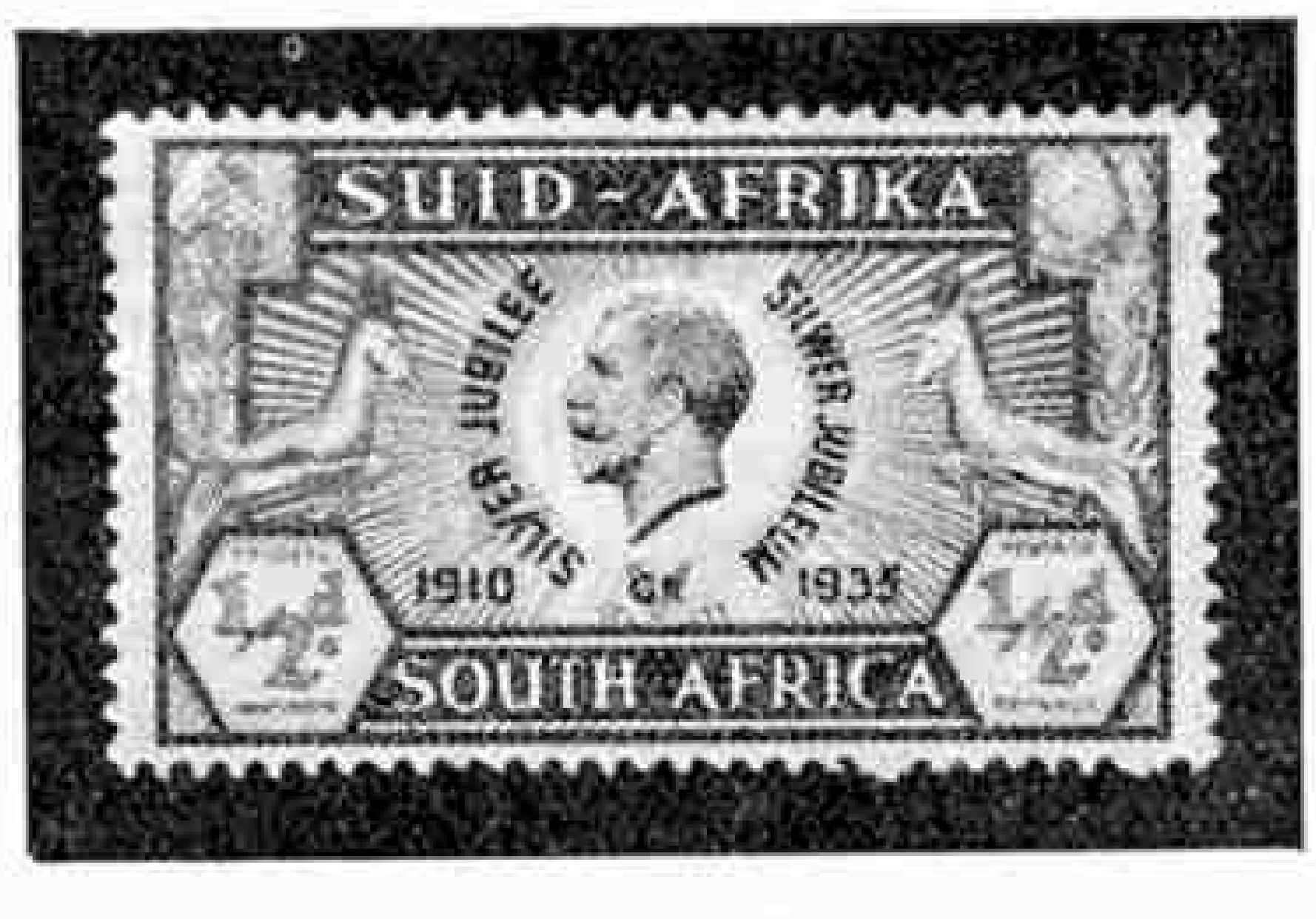
To abandon the stamp collection altogether during summer is really a very serious mistake, however. Stamp collecting is now an all-the-year-round hobby. Postal authorities cannot hold up the demands of their routine business merely because stamp collectors in Britain find other attractions than stamps in summertime. The flood of new issues goes on unabated throughout every month. The stamps reproduced here illustrate this point, for they are chosen from new issues that appeared last summer. The collector therefore simply has to maintain contact with the hobby if he wishes to be up-to-date. The object of our article this month is to show how to maintain that contact without unduly intruding upon hours that can be equally enjoyed in more strenuous pursuits.

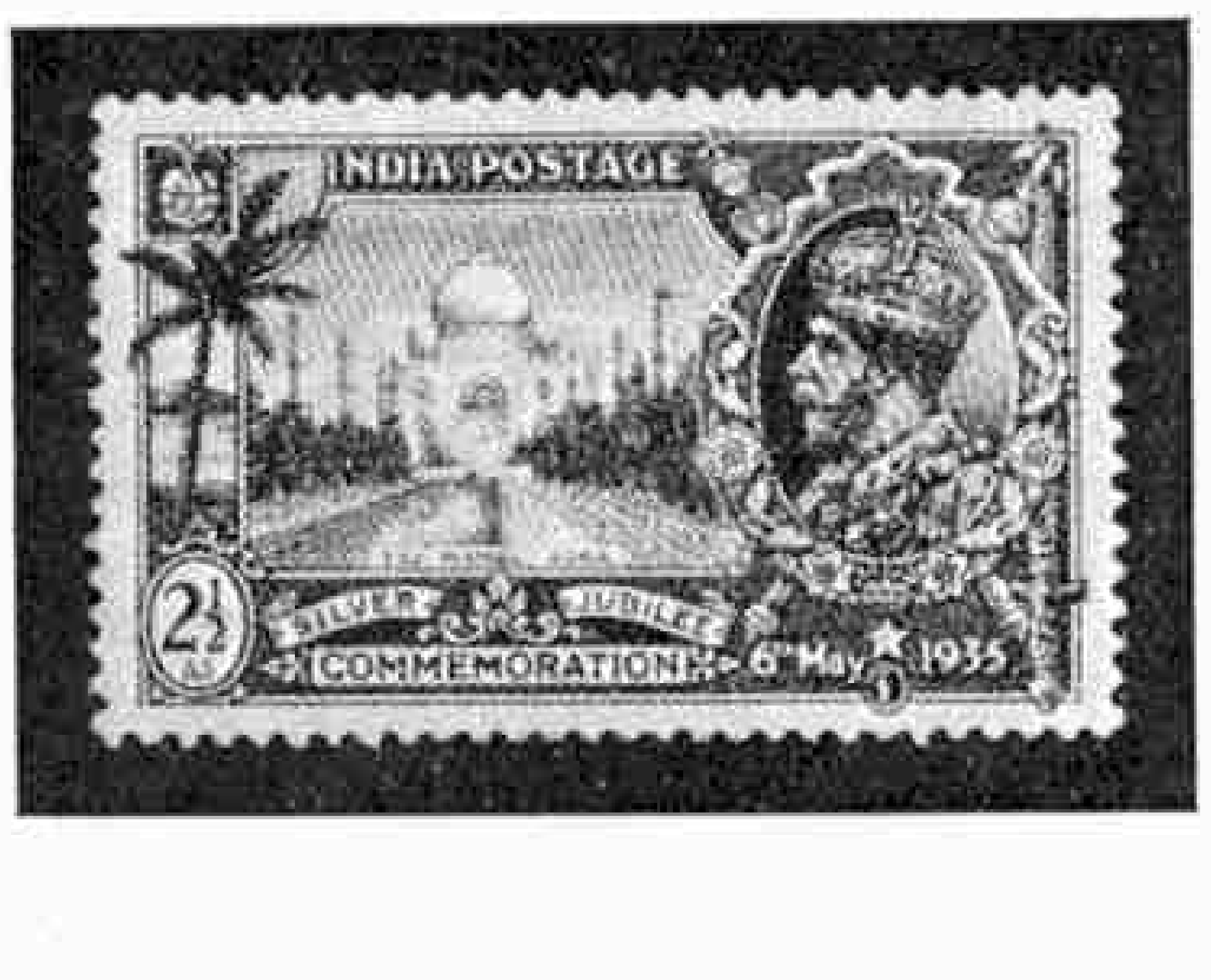


It is a simple matter to keep in touch with the new issues. It can be done in two ways. The first is by subscribing to a stamp magazine such as *Gibbons Stamp Monthly*, which includes every month a special supplement giving details of all new issues up to the time of going to press. The second is by subscribing to a new issue service. The usual arrangements for such a service provide for packets containing all new issues, or only certain types, such as Air Mails or British Colonials, up to a specified limit of face value, to be sent to the subscriber each month. The subscriber retains only those stamps he desires and returns the remainder. Usually the dealer running the service requires a preliminary cash deposit and a guarantee that stamps to a certain amount—a low figure usually—will be retained.



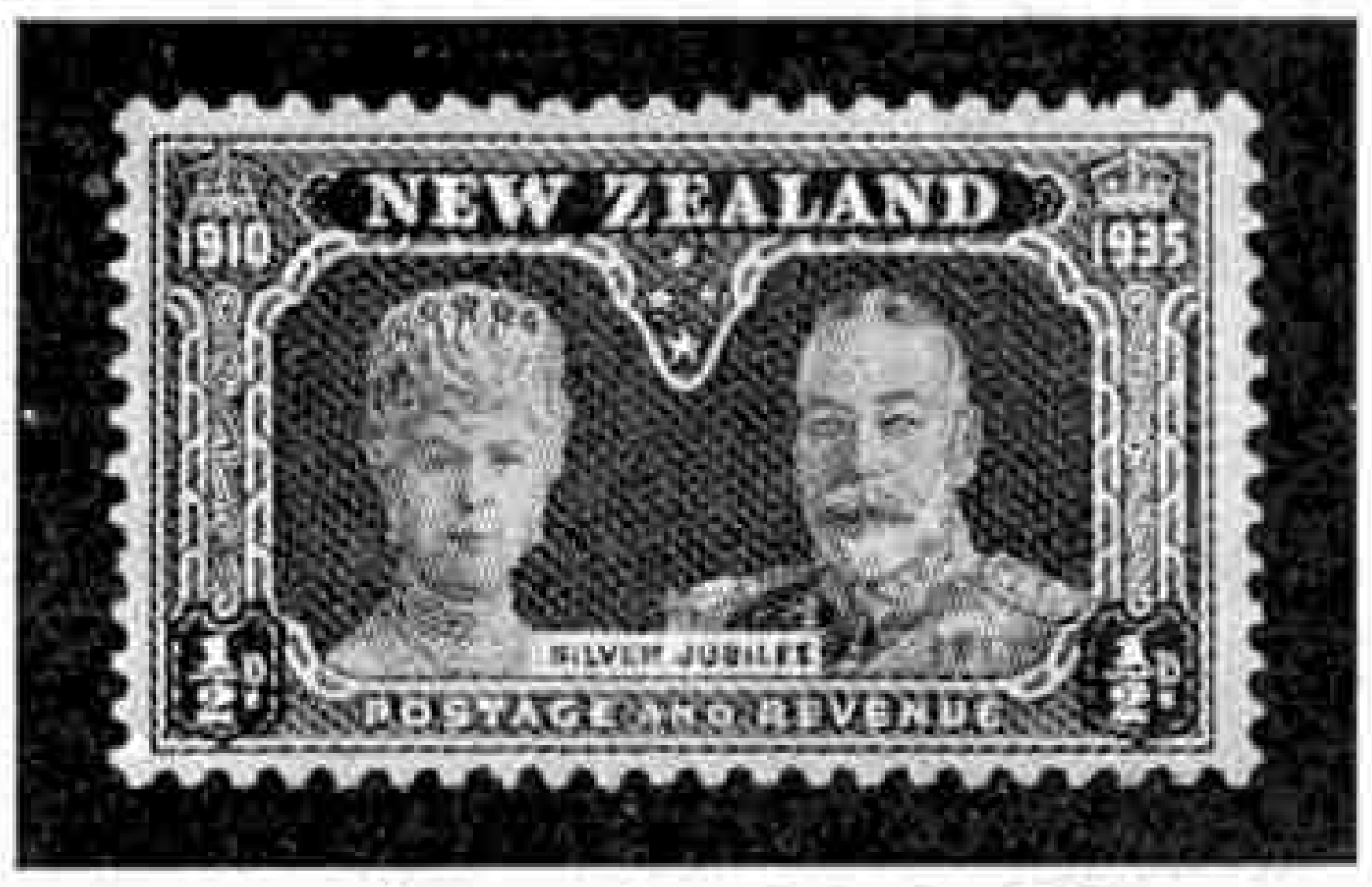
The time involved in looking over the new issues and deciding upon those to be purchased will not cut seriously into the time that might be devoted to games. One word of warning to the cricketing stamp collector, however. It is better to devote separate evenings to looking over stamps and oiling cricket bats. Linseed oil and mint stamps do not go well together!

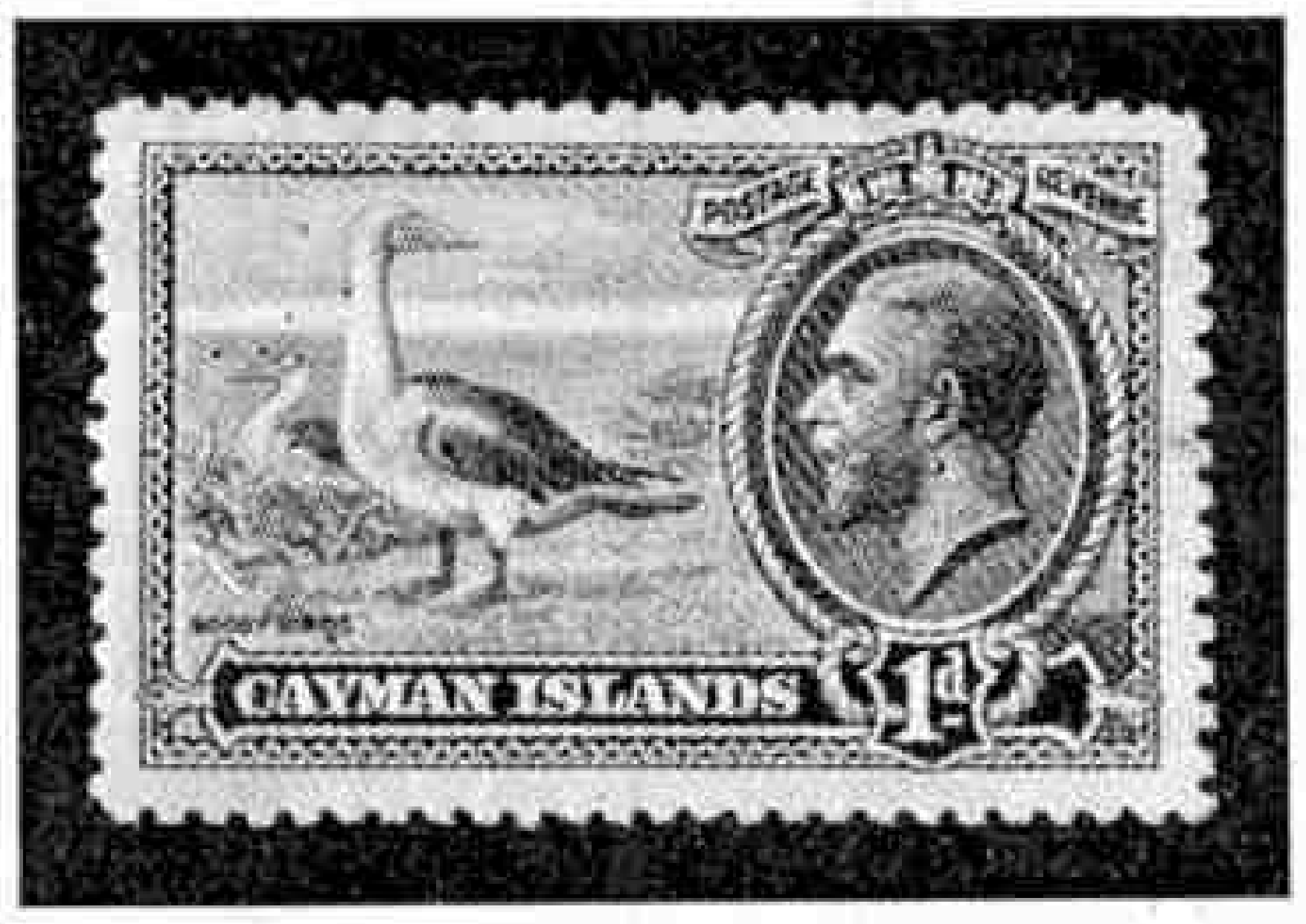




There are many little jobs around the collection that can be carried out in convenient stages and these tasks are just the thing for filling in odd moments in summer, when an engagement is cancelled at the last moment, for example.

Last summer we planned the layout of a new album, arranging the pages by ruling in the stamp positions lightly in pencil and indicating similarly the panels in which the writing-up was to be placed. We always like to draw in the lettered headings for the leaves of our albums, and the rough outlining of these, to serve as guides for the final work, was another congenial job that was spread over a series of odd half-hours. Later on, in the early autumn, the actual lettering in ink was done so that when the winter settled in, the whole of the album was ready waiting for the stamps themselves to be transferred from their old fixed-leaf printed album.





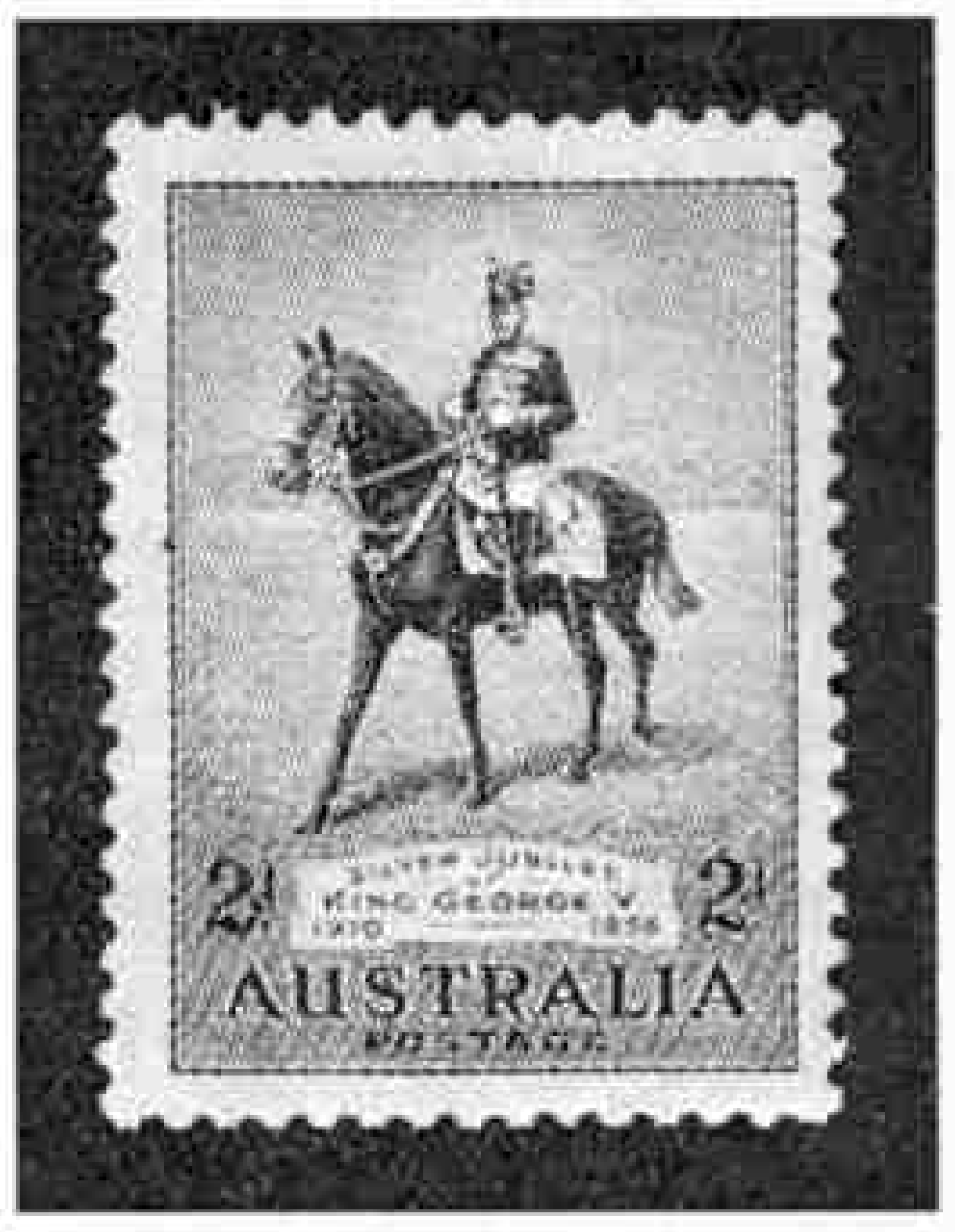
Many of our readers who are contemplating changing the method of their collecting next winter from a general all-countries arrangement to specialised subject collections, such as we have advocated in the *"M.M."* from time to time, would find the summer's odd moments amply filled by planning on the lines we have indicated. Provision can be made then not just for the stamps already possessed but also for those that will need to be acquired to complete the story.

Those inevitable rainy afternoons and evenings that make games impossible are just the occasions for mounting up new issues that have accumulated, or, if the rain is not too heavy, for getting into town and visiting the stamp shops with the object of acquiring wanted stamps. Summertime is haymaking time indeed for collectors who make a habit of visiting their dealers.

Innumerable opportunities of improving the collection present themselves. Stamp dealers cannot close down their premises for a few months because some of their customers have forsaken them temporarily. Instead they must provide special inducements that will encourage collectors to buy during the summer. These special inducements take the form of lower prices and special bargain offers. The summer collector gets the benefit of those offers.

Incidentally, because business is proceeding at less than normal pressure, dealers have more time to devote to individual customers and in most cases are able and willing to discuss their stamp problems and give advice.

We have indicated sufficient possibilities in this article to show to our readers the advantages of maintaining contact with their stamps during the summer. The fact that bargains are to be picked up is really the least of these, and in our view the greatest dividend that any collector should look for from his stamp investments is in the form of life-long interests and enjoyment. A collection that is constantly cared for month in month out throughout the year will provide a steadily growing fund of pleasure. We urge all our readers to care for their collections this summer. The advantages will be obvious next winter.



FREE

COMMEMORATIVE PACKET

This Grand Packet of Commemorative issues only, including **Germany NEW ISSUE** (19th and 20th Century Locomotives), Italy (Augustus The Gt.), Hungary (St. Elisabeth), Poland 1930 Revolution Centenary, etc., etc., is **FREE** to genuine applicants for my modern approvals, sending 2d. postage, etc. (6d. abroad).

THIS MONTH'S SPECIAL OFFER—GRAND PACKET OF 25 DIFFERENT BRITISH COLONIAL SILVER JUBILEES 3/6.

S. CAMPBELL, 71, Manor Rd., Tankerton, Kent

ARE YOU AIRMINDED ? ? ?

Yes! Then send for the greatest Airmail Packet we have ever offered. Besides the attractive △ **Air Stamp** of **Mozambique,** the packet includes **Egyptian, Indo-China, Latakia, Ecuador, Spain** and **Syrian** Airmails. Some of the most famous aircraft built are depicted on the beautiful stamps of this magnificent packet.

1/6 USUALLY SOLD AT 1/6. FREE AND POST FREE to approval applicants.
THE UNIVERSITY STAMP CO., 12, WALTON WELL ROAD, OXFORD. **FREE**

CHEAP APPROVALS

My beautiful Approval Selections are ideal for filling those vacant spaces. Pictorials, Colonials, and hard to get items. Selections from 4 a 1d. Free Gift Bi-coloured Persia all applicants.

A. V. TAPP,
108, CHESTERFIELD RD., BRISTOL

KING GEORGE V—Important Notice

THE STAMP OF TO-DAY IS
THE RARITY OF TO-MORROW

Owing to the death of His Majesty King George V, all current British Colonials will shortly be obsolete. So now is your chance to obtain them before they become scarce.

I am therefore introducing EMPIRE MIXTURE guaranteed to contain only unsorted British Colonials, sent out exactly as received from Banks, Trading Stations and other Outposts of the Empire.

EMPIRE MIXTURE is the cheapest and best way to fill up the gaps in your British Colonial Collection, includes Silver Jubilees, Commemoratives, New and Obsolete Issues, Provisionals and heaps of other scarce stamps.

100 for **1/-**, 250 **2/-**, 500 **3/9**, 1,000 **7/3**. All post free (abroad 3d.).

As a special introductory offer I am giving to all purchasers of **3/9** or over a Queen Victoria Labuan stamp, cat. 2/6.

Remit by Postal Order only.

K. HUMPHRIES, Dept. M., East Wittering Rd., East Wittering, Chichester, Sussex.

100 DIFFERENT STAMPS FREE to applicants for ½d. approvals.—Cox, 21, Dennis Mansions, Westcliff.

FREE. 25 Superior Stamps. Ask for approvals.—Goodwin, 9, Robin Hood Street, Nottingham.

100 diff. Stamps Free to approval applicants, good discount.—Gosling, 21, Powling Road, Ipswich.

JUBILEE. Iraq officials and Colonials free! Request appros. Post 1½d.—G. Kingsmill, New Barnet, Herts.

500 Stamp Mounts Free to bargain approval applicants.—Winter, 89, Cobham Road, Seven Kings.

600 BRITISH COLONIALS on approval. Pick at ½d. each.—Sanders, 90, Newlands Avenue, Southampton.

100 Different Stamps Free to approval applicants. Liberal discount.—Cuthbert, Newsham Lane, Broughton, Preston.

The "STRAITS, KING GEORGE" Packet absolutely free to genuine applicants for approvals.—Edward Lord, Grafton Road, Keighley.

SPECIAL POST This wonderful free **SPECIAL POST** packet contains stamps used for Air Post, Express Delivery Post, Registration Post, Parcel Post, Special Delivery Post, Newspaper Post, Railway Post, etc., from many countries. It's a most interesting gift, and will be sent **FREE** to all genuine applicants for a selection of stamps on approval who enclose 2d. stamps. Clients who do not want approvals may obtain it by sending a P.O. for 1/-. **OFFERS** 5 Gibraltar 4d., 10 1/-, 15 1/6, 50 5/-. 10 New Hebrides 1/3, 25 Malta 1/6, 25 Palestine 1/6, Post extra.

WINDSOR STAMP CO.
(M.M. Dept.), 59, Lee Road, Blackheath, S.E.3.

1/- SENSATION PACKET 1/-

As a special stocktaking clearance offer, we have made up a limited number of bargain packets containing the following: Australia **Jubilee** (King on Horseback), Mozambique **Air Mail Triangular,** Chili 1 peso **(Cat. 9d.),** Australia (Merino sheep), superb large Spanish **Triangular** (Flagship of Columbus), the beautiful Belgium **Astrid** mourning issue, and many other wonderful stamps which will enrich any collection. Price whilst they last: **1/-** each Post Free. Cash with order.

MICHAEL HERBERT (M.M.),
8, Woodstock Road, Walthamstow, E.17.

SPECIAL OFFERS

100 PERSIA, all different, incl. Air 2/9
17 PERSIA Coronation, incl. Gold & Silver frames 1/6
SPANISH SETS (very fine pictorials)
9 Columbus, 5 Ships, 3 Air, 1 Triangle ... **9d.**
7 'Goya' Comm., incl. 2 Air ... ... **6d.**
7 'Goya' Comm. **AIR MAILS ONLY** **1/-**
WANTED TO BUY! USED COLONIAL JUBILEES.
Correspondents wanted in all Colonies.
Cash with order. Postage extra.
T. R. Hughes, 'Ibis Cottage,' Long Park, Amersham, Bucks.

Stands for HORNBY SPEED AND RACING BOATS

Every owner of a Hornby Speed or Racing Boat who prides himself on taking care of his model should obtain a Hornby Boat Stand on which to place his boat when it is not in use. The Stands are available in the following sizes: No. 1 for No. 1 Speed Boats; No. 1R for No. 1 Racer; No. 2 for No. 2 Speed Boat and No. 2 Racer; No. 3 for Nos. 3, 4 and 5 Speed Boats and No. 3 Racer. They can be obtained from any Meccano dealer price 9d. each (any size).

MECCANO LTD., Binns Road, Liverpool 13

"Meccano Parts and How to Use Them"

Every keen Meccano enthusiast wishes to carry out his model-building operations in accordance with correct engineering principles. In order to do this he must know the special functions of each of the parts that comprise the Meccano System, and to assist him in acquiring this knowledge there is published a manual entitled "*Meccano Parts and How to Use Them.*" In this manual all the parts in the system are listed and classified, and the uses of each individual part are described in detail. The descriptions are assisted by half-tone illustrations and sectional diagrams showing the parts actually in use in Meccano structures and mechanisms.

Ideal for the Model-Builder

An important section of the book is devoted to the various forms of Meccano motive power, and gives much useful information regarding the use of the Meccano Electric and Clockwork Motors. This manual forms an ideal constructor's guide and book of reference, and should be in the possession of every Meccano boy.

"*Meccano Parts and How to Use Them*" may be obtained, price 6d., from any Meccano dealer, or direct from Meccano Ltd., Binns Road, Liverpool 13, price 7d. post free.

Binding the "M.M."

There are two methods of binding the "*M.M.*" to preserve back copies from the mutilation that inevitably will be theirs should they be handled for any lengthy period without protection. First there is the spring-back binder system, that permits the copies to be inserted or removed from the binding case at will. This is intended primarily as a temporary arrangement for the protection of copies during the currency of their volume.

Handsome spring-back cases specially prepared for the "*M.M.*", with the name blocked in gold letters on the front cover, can be obtained from Meccano Limited, Binns Road, Liverpool 13, price 2/6 and 3/6 for sizes large enough to hold 6 and 12 copies of current issues respectively.

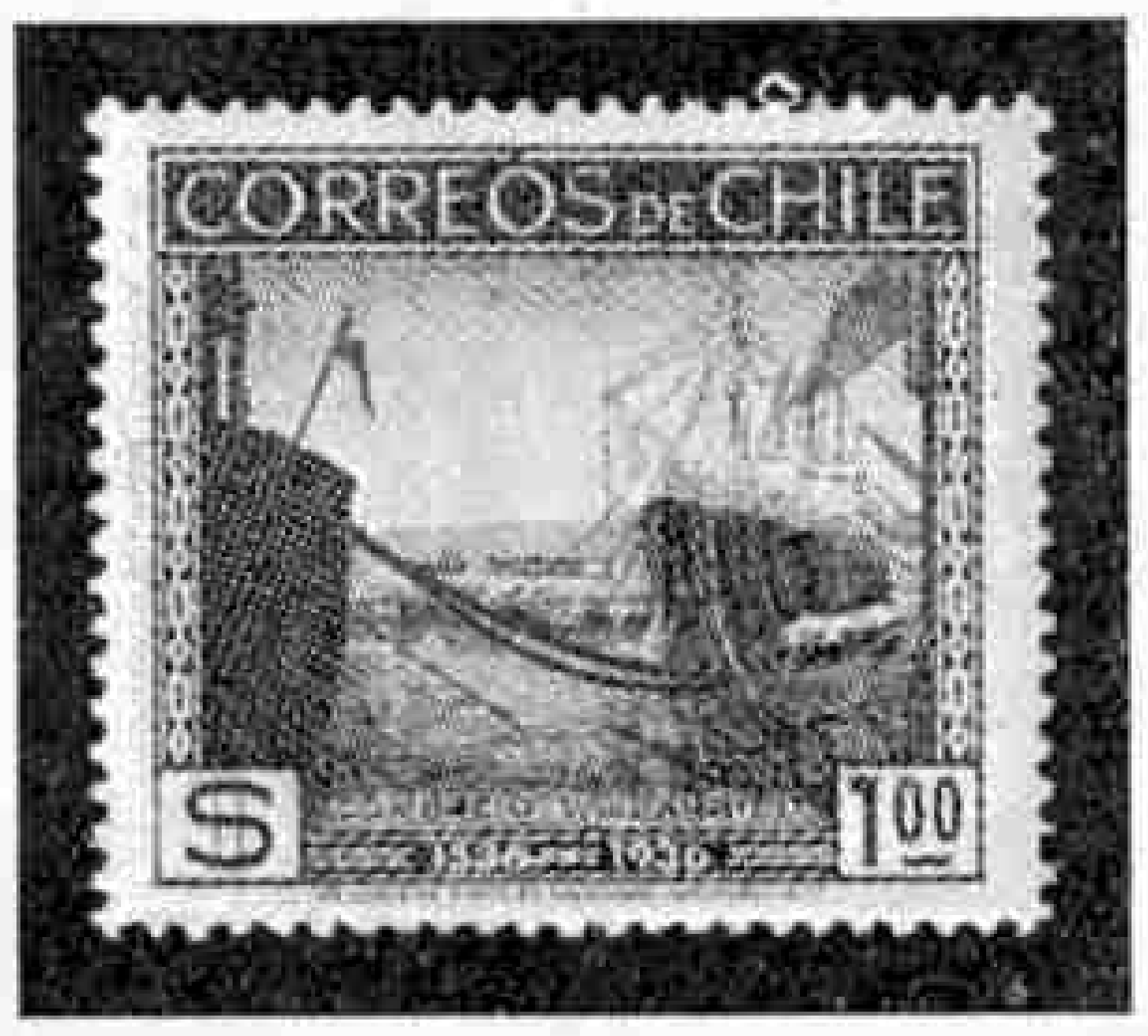
Permanent binding cases for back numbers of the Magazine can be supplied by Messrs. O. H. Bateman and Co., 23, Hanover Street, Liverpool. These cases are supplied in two sizes (1) for six copies, price 3/3 and (2) for twelve copies, price 4/9, post free in each case. The binding cases are supplied in what is known as "Quarter Basil, full cloth"—that is to say three-quarters of the sides are dark crimson cloth and the back and a quarter of the sides are dark crimson leather as shown above. The case is tastefully embossed in gold with the name "Meccano Magazine," and on the back is the name and volume number.

Binding Six or Twelve Copies

These binding cases are supplied so that readers may have their Magazines bound locally, but where desired, the firm mentioned above will bind Meccano Magazines at a charge of 5/9 for six issues or 7/6 for twelve issues, including the cost of the binding and also return carriage. The covers of the Magazines may be included or omitted as required, but in the absence of any instructions to the contrary they will be included.

Whilst the binding of the twelve Magazines is quite satisfactory, they form a rather bulky volume and for that reason arrangements have been made to bind six months' Magazines where so desired, as explained above. Back numbers for any volume can be bound and the case will be embossed with the volume number.

Readers desiring to have their Magazines bound need only make a strong parcel of them, include a note of their name and address together with the necessary remittance, and send the parcel direct to Messrs. O. H. Bateman and Co., carriage paid.



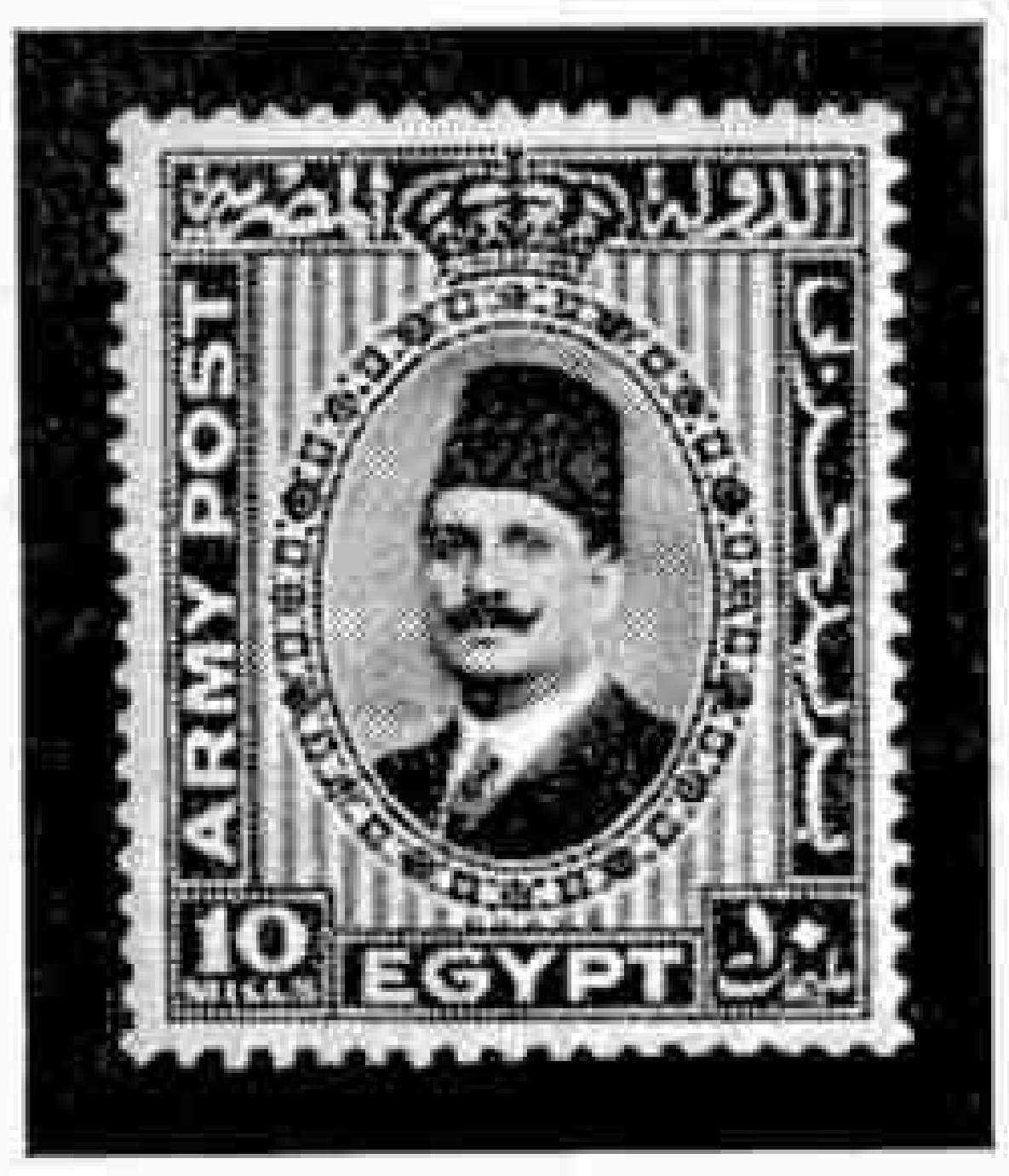
Stamp Gossip

and Notes on New Issues

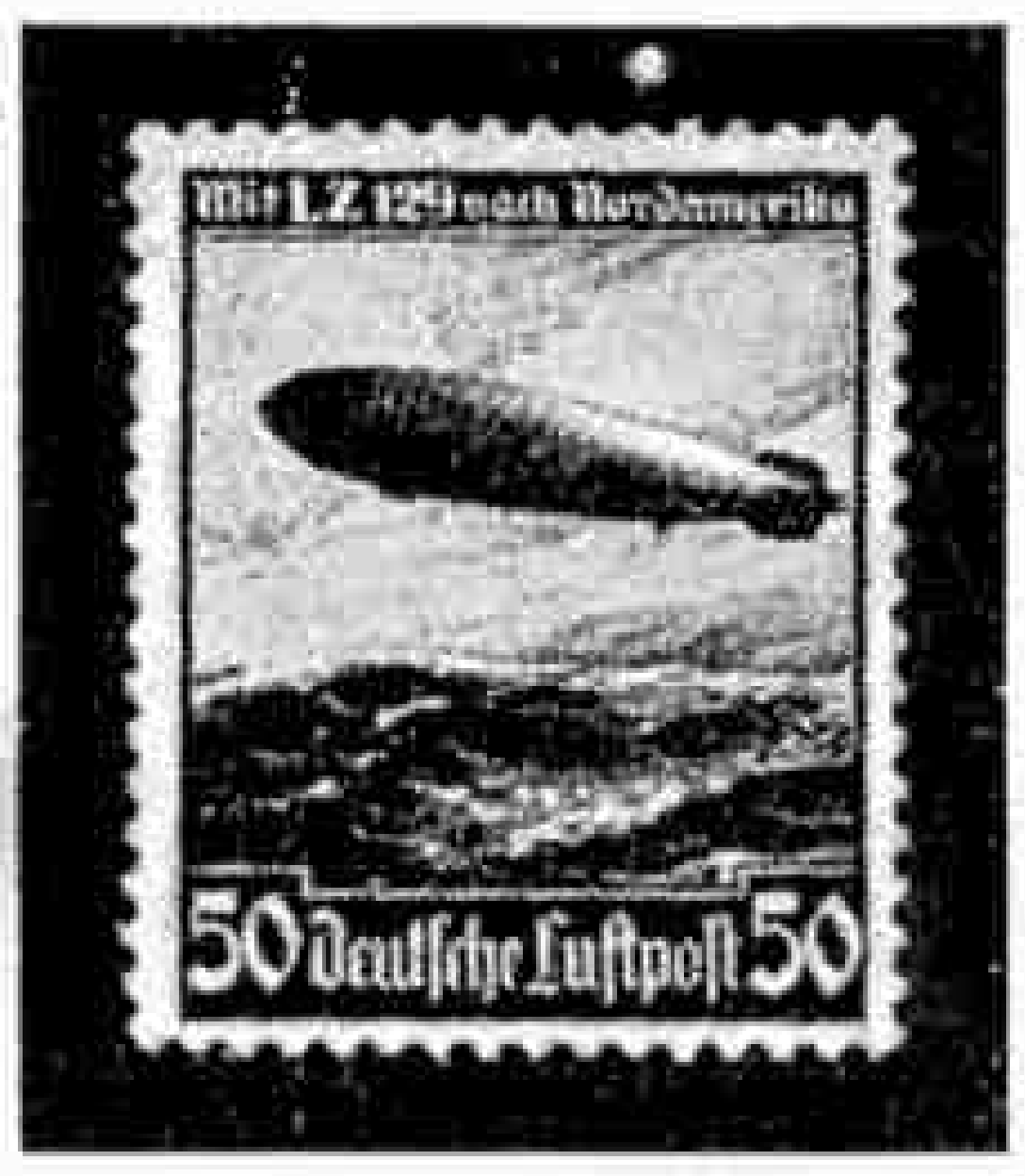
Egyptian Army Post Issues

The Egyptian post office have placed on sale a special Army Post stamp, illustrated here, for the use of the British Forces in Egypt. The stamp shows a portrait of the late King Fuad and is inscribed "Army Post." The issue has been on sale since 1st March.

This issue is to replace the special seals issued by the Navy, Army and Air Force Institute by arrangement with the postal authorities and thus there disappears one of the most interesting stamp issues of recent years.



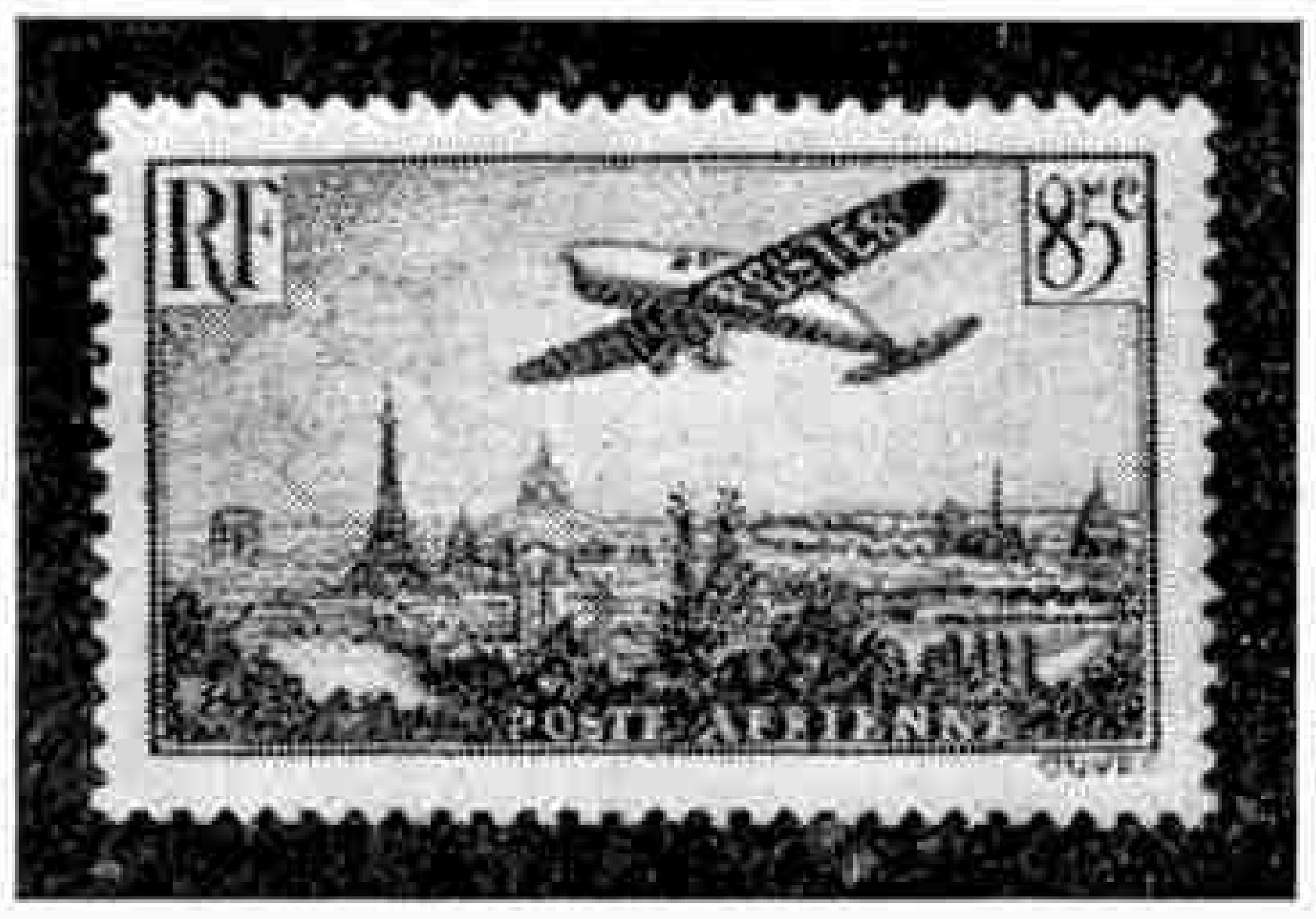
The N.A.A.F.I seals were introduced in November, 1932 to enable British Forces in Egypt and their families to send ordinary letters to the British Isles, including the Irish Free State, at a reduced price. They were not available to prepay postage to any other parts of the world, and it was a strict requirement of the scheme that the correspondence must be posted in a regimental post-box. Letters posted in ordinary Egyptian post-boxes, although bearing the letter seal, were surcharged, and thus there arose the curious situation that actually the post-mark, and not the label, was the authorisation for carriage at the reduced rate. Indeed, in certain quarters this fact is the basis of a refusal to recognise the seals as postage stamps.



The new Army post stamp will be covered by precisely the same regulations for use, but its official issue by a postal authority gives it an unchallengable status.

The Late King Fuad

There is an old saying that misfortunes rarely come singly, and philatelists the world over must have thought of this old saw when they learnt of the death of His Majesty King Fuad of Egypt, who vied with our own late King George for premier place among royal philatelists.



King Fuad's interest in stamps commenced in his boyhood days and his personal collection, housed in 36 volumes, ranged over a very wide field of interest. In recent years, however, the late King had specialised, principally in the stamps of his own country and his Egyptian collections are without equal.

His Majesty The King

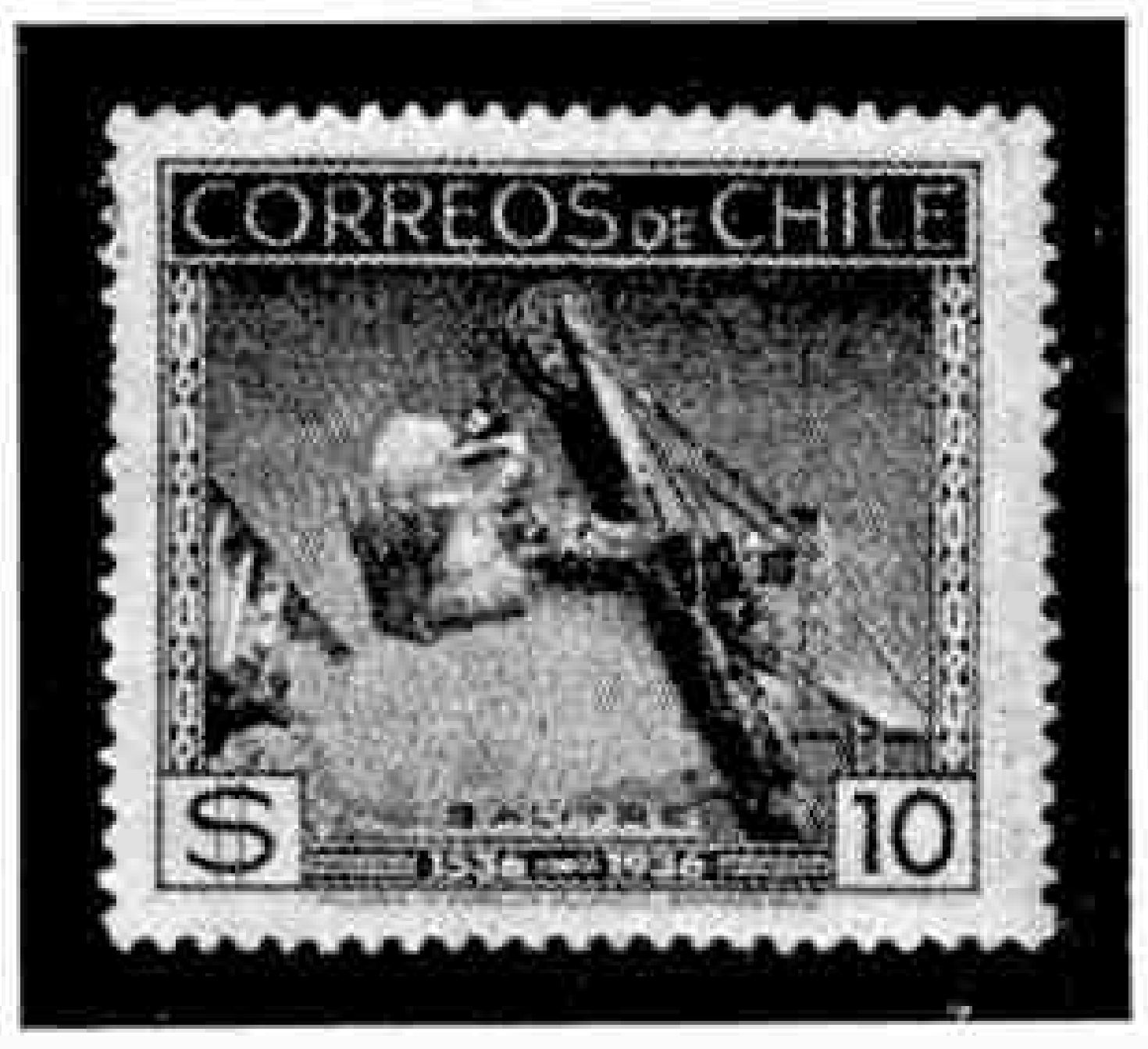
Our stamp collecting readers throughout the world will be pleased to learn that His Majesty King Edward VIII has been graciously pleased to grant his Patronage to the Royal Philatelic Society.

Thus the royal connection with stamp collecting maintained so closely by the late King George will be preserved.

Chilian Pictorials

The 400th anniversary of the discovery and conquest of Chile by Spain, represented by Diego de Almagro, in 1536 has been commemorated by the issue of a long set of 12 pictorial commemoratives featuring the agricultural and industrial features of the country.

The stamps range from 5 centavos up to 10 pesos in value, with designs as follows: 5c., the Atacama desert, one of the important locations of the Chilian nitrate industry. 10c., an oyster fishing fleet off Chiloe. 20c., Ocoa Palm trees, a variety of coconut that produces a fruit no bigger than a walnut; the sap of this tree provides a pleasant syrup. 25c., sheep farming. 30c., copper mines in Chile, which is one of the world's largest producers of copper. 40c., Araucanian Palms; this tree produces the piñon nut, which is somewhat like a brazil in appearance and a chestnut in taste. 50c., a view of the coal port of Lota. 1 peso, the wharves at Valparaiso, 1 p. 20, All Saints Lake, with the Volcano Puntiagudo in the background. 2 p., a portrait of Diego. 5 p., a group of cattle. 10 p., a mechanical shovel at work in the nitrate fields.

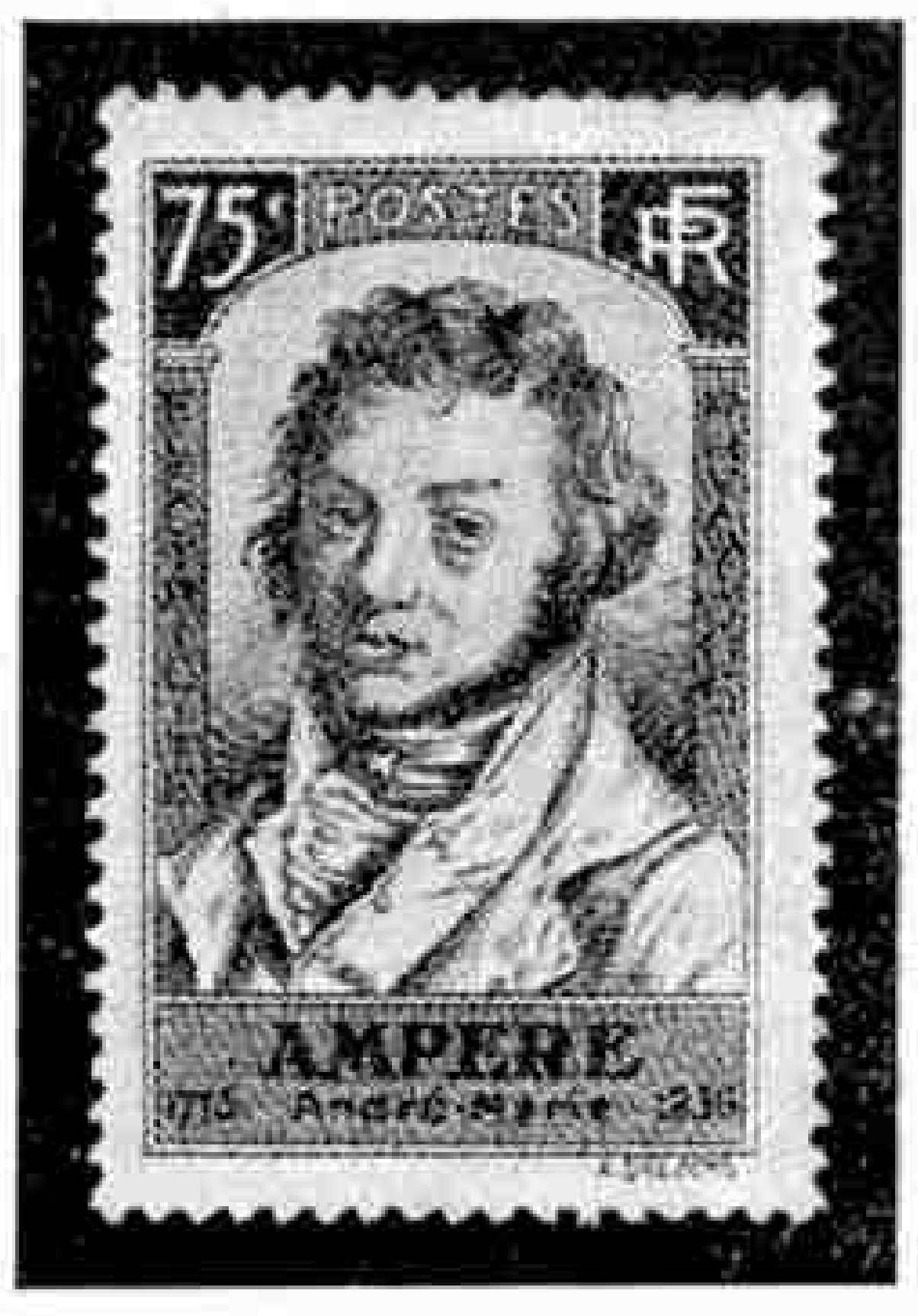


A House for Stamps

The most unusual advertisement we have ever seen in a philatelic newspaper appeared recently in "*Stamp Collecting*," in which Mr. Robson Lowe, the London stamp dealer, offered a modern house on Wimbledon Common in exchange for a stamp collection on behalf of one of his clients. To avoid any misunderstanding, let us hasten to add that the cash value of the collection would need to be in the neighbourhood of £2,000 before it would be of interest to the collector responsible for the advertisement.

Ampère Commemorative

The 100th anniversary of the death of the French scientist Andre Ampère was celebrated by France on 27th February last by the issue of a 75c. commemorative stamp bearing a portrait of the scientist.



Ampère was born in Lyons in 1775 and very early in his career showed promise of great brilliance. After holding teaching posts at Bourg and Lyons from 1801–5, he was appointed Professor of Analysis at the Polytechnic School, Paris, in 1809, and became Professor of Physics at the College de France in 1824. His fame rests particularly on his researches in electro-dynamics and his demonstration of the relations between magnetism and electricity. Ampère's pioneer work in electrical science was recognised by the adoption of his name to signify the unit of electrical current strength.

Also in February, France issued a new air mail series of six stamps ranging in value from 85c. to 3 F. 50. Each stamp uses the design illustrated here, showing an aeroplane flying over Paris. Those of our readers who know Paris will be interested in seeking to identify many of the famous landmarks that can be picked out in the stamp design, such as the Eiffel Tower, L'Arc de Triomphe, the Church of the Sacred Heart at Montmartre, and Notre Dame Cathedral.

L.Z. 129

The new German Zeppelin "*Hindenburg*" will shortly be as famous on stamps as its illustrious predecessor "*Graf Zeppelin.*" The special stamp illustrated on this page was issued in March to celebrate the giant airship's flight across the North Atlantic early last month. The design depicts the airship in flight across the Atlantic, and at the head of the stamp is the inscription "With L.Z. 129 to North America."

* * * * *

In our next issue we hope to illustrate specimens from Germany's Olympic Games issue that was placed on sale on 9th May. The set contains eight excellent sporting designs.

We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations on this page have been made.

FIRESIDE FUN

TRAVELLING LIGHT

Two negros were talking about the possibilities of a war. Sambo said: "I'm going to join the Cavalry." "Not me," said Rastus, "When de retreat am sounded, I don't want to be hampered by no hoss."

* * * *

Well-meaning Old Lady: "Are you going to Mrs. Smith's funeral, sir?"

Doctor: "No, I very seldom go to any of my patients' funerals."

Old Lady: "No, I suppose you might be doing nothin' else, sir, if you was to."

* * * *

Specialist: "Could you pay for an operation if I thought one was necessary?"

Patient: "Would you find one necessary if I could not pay for it?"

* * * *

Teacher: "Tommy, give me a definition of the word 'luck'."

Tommy: "A man was murdered in the street for his money. But he had left all his money at his office. That was luck."

* * * *

Magistrate: "What have you to say to this charge of begging?"

Tramp: "Well, it was not my fault, sir; I just held my hand out to see if it was raining and the gentleman dropped a coin in it."

* * * *

During a history lesson the teacher pointed out to the class that a surname often indicated the trade of the ancestors of those who bore the name. He gave the simple examples of Smith, Taylor, Baker and others.

Then he questioned one of the boys: "What were your ancestors, Webb?"

"Must have been spiders, sir!"

* * * *

The Irish foreman found one of his men asleep. "Slape on, ye idle spalpeen," he said. "So long as ye slape, ye've got a job; but as soon as ye wake up ye're out of wurrk!"

* * * *

The ferryman was asked by a timid lady in his boat whether any persons were ever lost.

"Oh, no," said he, "we always find 'em the next day."

* * * *

Mother: "Eat up your spinach, Molly. It puts strong, white teeth into your mouth."

Molly: "Then why don't you give some to grandpa, mummy?"

* * * *

Diner: "I want some chicken, and the younger it is the better."

Waiter: "How about an egg, sir?"

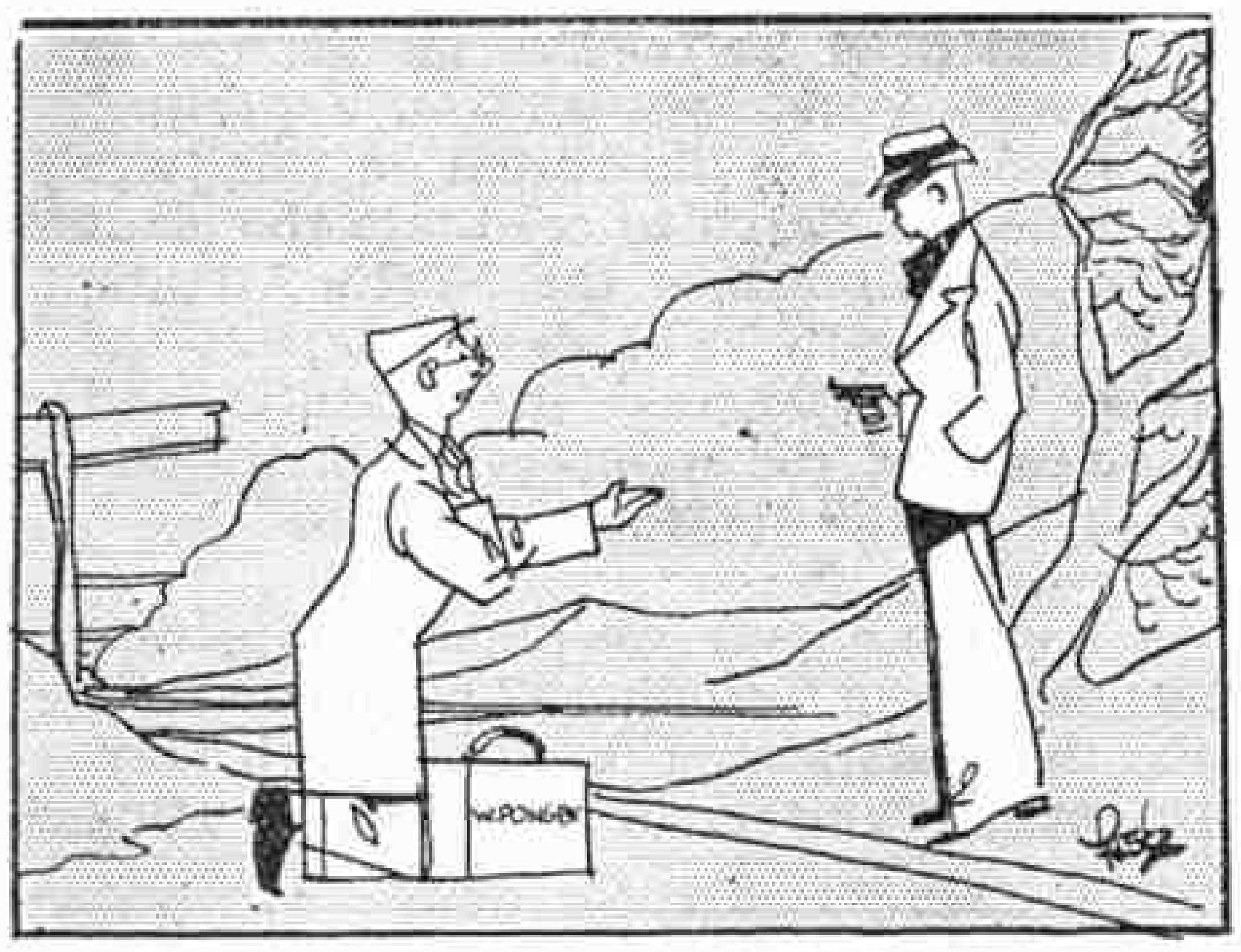
* * * *

Maisie: "Do you think those cookery classes accomplish anything?"

Polly: "Sure I do. I haven't seen a tramp around the place since they started."

* * * *

THRIFTY!



Bandit: "Your money or your life."

Traveller: "Take my life; I'm saving my money for my old age."

NOT GUILTY

An old negro in a Missouri town was applying for registration papers.

"What is your name?" asked the official.

"George Washington," was the reply.

"Well George, are you the man who cut down the cherry tree?" asked the other.

"No sir, I ain't de man. I ain't done no work for nigh onto a year."

* * * *

MISUNDERSTOOD

Chatty Traveller (of short stature): "I'm a little stiff from hiking."

Short-tempered Grocer: "I don't care where you come from. Let me have a look at your samples."

* * * *

A man entered a country post office. "Have you a parcel for Mr. Jones," he asked.

"Ay," said the postmaster, "but how do I know you to be him?"

The man produced a photograph of himself. "Have a look at that," he said. "It's me, isn't it?"

"My, so it be," said the postmaster, handing over the parcel without another word.

* * * *

Little Betty (annexing the largest slice of cake): "Well, I s'pose it's no use being ladies first if you can't take the biggest piece."

* * * *

Father: "I don't want Jack to see his present until his birthday."

Mother: "I'll put it in the bathroom, he'll never think of looking there."

* * * *

First Clerk: "Have you and your boss ever had any difference of opinion."

Second Clerk: "Yes, but he doesn't know it."

* * * *

An American visitor to England was standing on a platform of a station when the "*Royal Scot*" rushed through.

"Do you call that an express?" he asked a porter.

"Bless your life, no!" replied the porter. "That's Bill doin' a bit o' shunting; he'll be back in a minute."

* * * *

Angler: "Yes, the fish was too small to bother with, so I got two men to throw it back."

* * * *

Teacher: "As we walk outdoors on a cold winter's morning and look about us, what do we see on every hand?"

Pupil: "Gloves."

* * * *

Having read that rare stamps fetch high prices from philatelists, a man in the South of England is treasuring one that has come into his possession. It is a 1½d. stamp on a postcard bearing the postmark "Aberdeen."

* * * *

Pessimist: "Cheerful? How can I be cheerful when every bone in my body aches?"

Optimist: "Well, you might at least be thankful that you are not a herring."

* * * *

As little Frank was out walking with his mother they passed a lady wearing a veil.

"Oh," exclaimed Frank, "why have they put wire netting round the poor lady's face?"

ALL SQUARE

Jones: "I'm awfully sorry my fowl got into your garden, and made a mess of it."

Smith: "That's all right, my dog has killed your fowl."

Jones: "Don't apologise, because my car has just killed your dog."

* * * *

Visitor: "Who is the responsible man in this firm?"

Office Boy: "I don't know who the responsible party is, but I get all the blame."

* * * *

An Englishman lost in a mist on a Scottish moor met a native and said: "I am lost."

The native replied: "Is there any reward for findin' on ye?"

Englishman: "No."

Native: "Then ye're still lost."

* * * *

A motorist was accused of exceeding the speed limit. The magistrate, calling for evidence, asked a country constable at what speed the defendant was travelling.

"Well, indeed sir, I do not know. He was going so fast I did not see him till he was out of sight!" said the constable.

* * * *

An old lady and her small niece were at a cricket match when it started to rain, and the players ran for shelter.

Little girl: "Fancy a little shower like that stopping the game."

Auntie: "Well, my dear, you see only three of them are wearing mudguards."

* * * *

Teacher: "Who can tell me what the former ruler of Russia was called?"

Class (in unison): "Tsar."

Teacher: "Correct; and what was his wife called?"

Class: "Tsarina."

Teacher: "What were the Tsar's children called?"

There was a pause and then a timid voice in the rear piped up "Tsardines."

* * * *

Football Club Manager: "I've found the very player we want. Eye like a hawk, body like a bullock, speed of a racehorse, kick like a mule."

Director: "It's a centre forward we want, not a farmyard."

* * * *

Mother (sternly): "You mustn't be conceited, Betty. You are always looking in the mirror."

Betty: "I'm not conceited, mummy. I don't think I'm half as good looking as I really am."

* * * *

Porter: "Anything else now, Ma'am?"

Old Lady: "Yes, you might run to the other end of the train. I want to test the communication cord."

* * * *

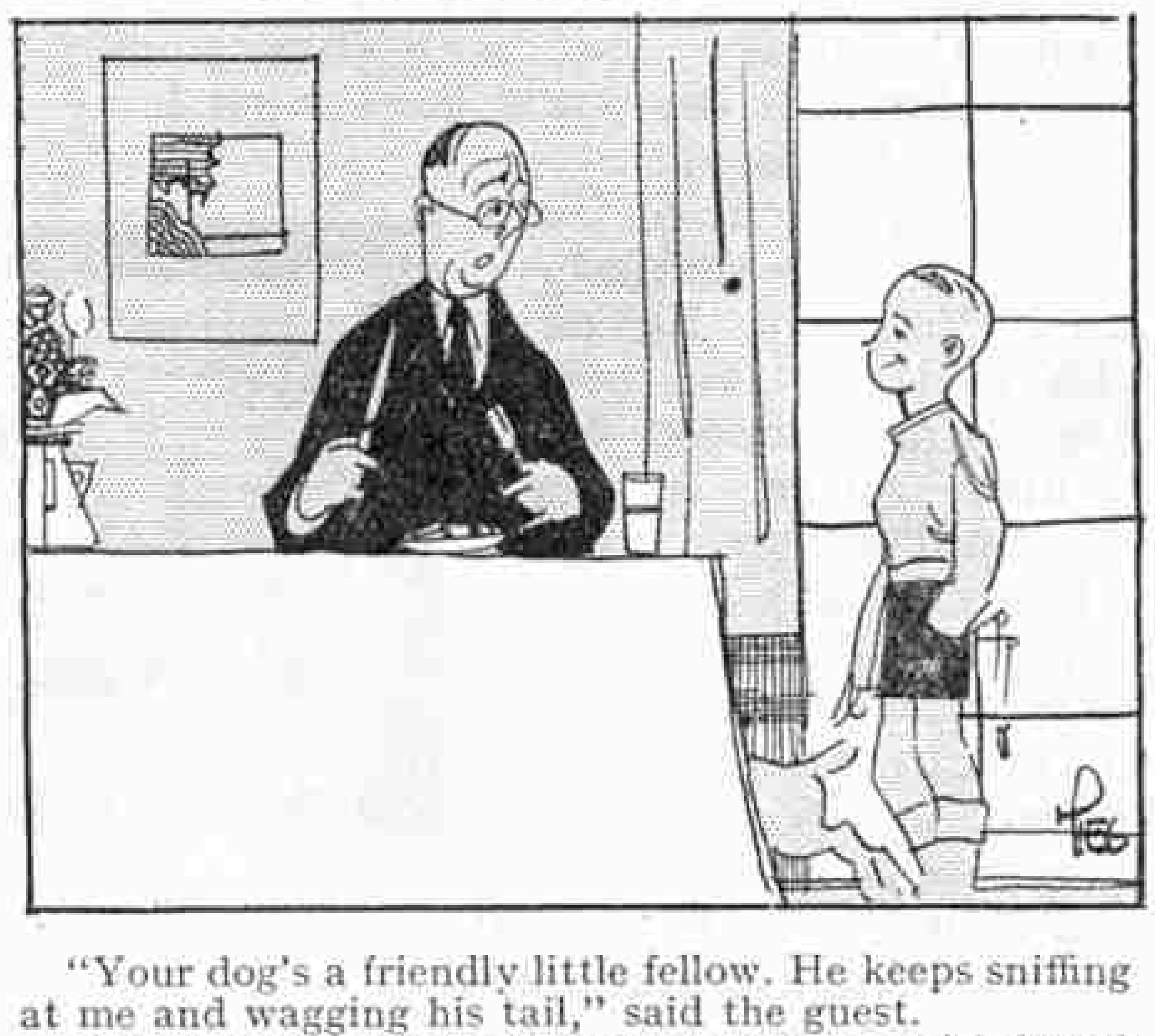
Jones: "Won't you have something more to eat, Mr. Smith?"

Smith: "Well—thank you—just a mouthful."

Jones: "James, fill Mr. Smith's plate."

* * * *

HIGHLY HONOURED



"Your dog's a friendly little fellow. He keeps sniffing at me and wagging his tail," said the guest.

"Oh, I expect that's because you've got his plate," said the small boy of the family.

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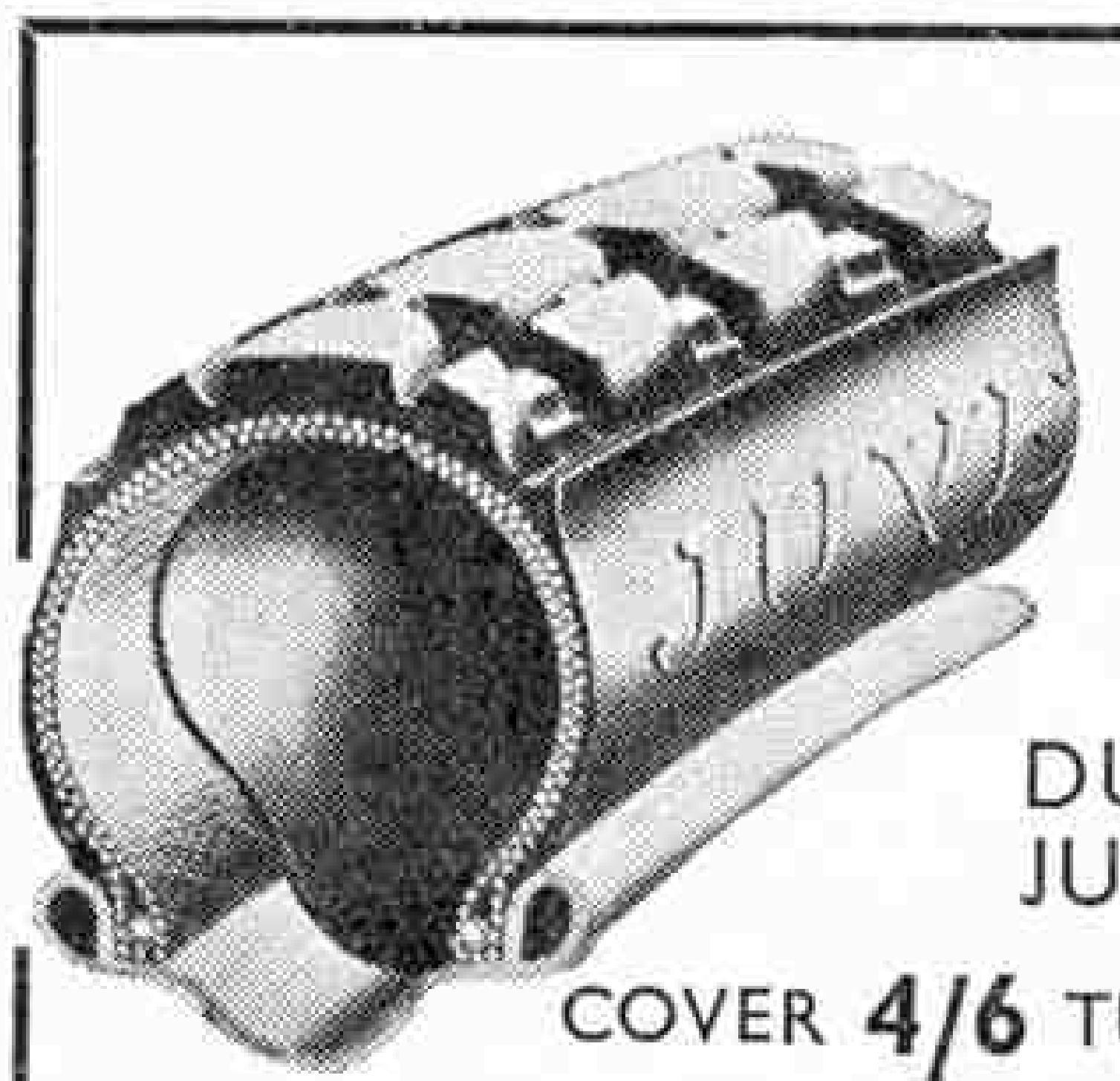

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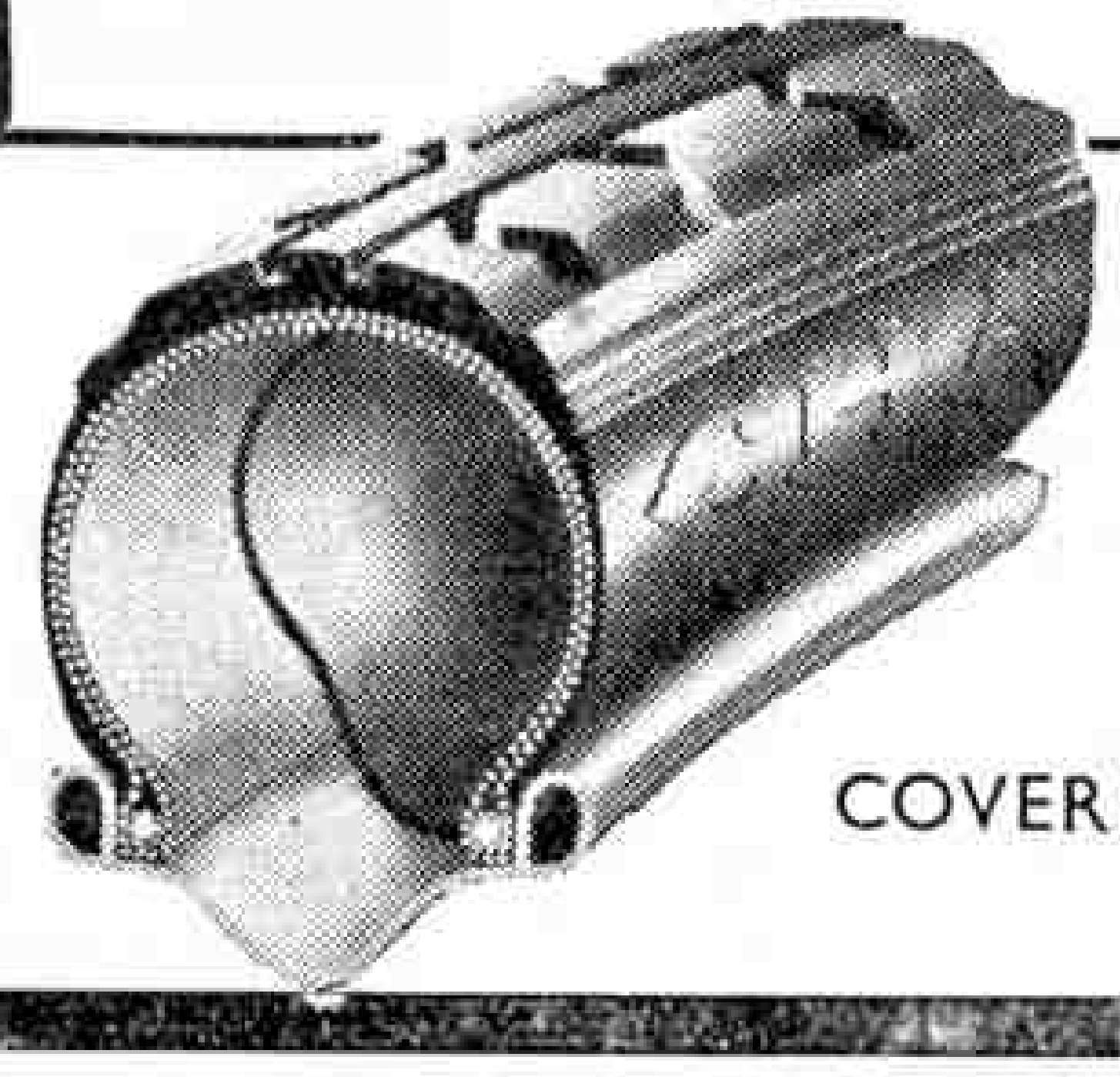

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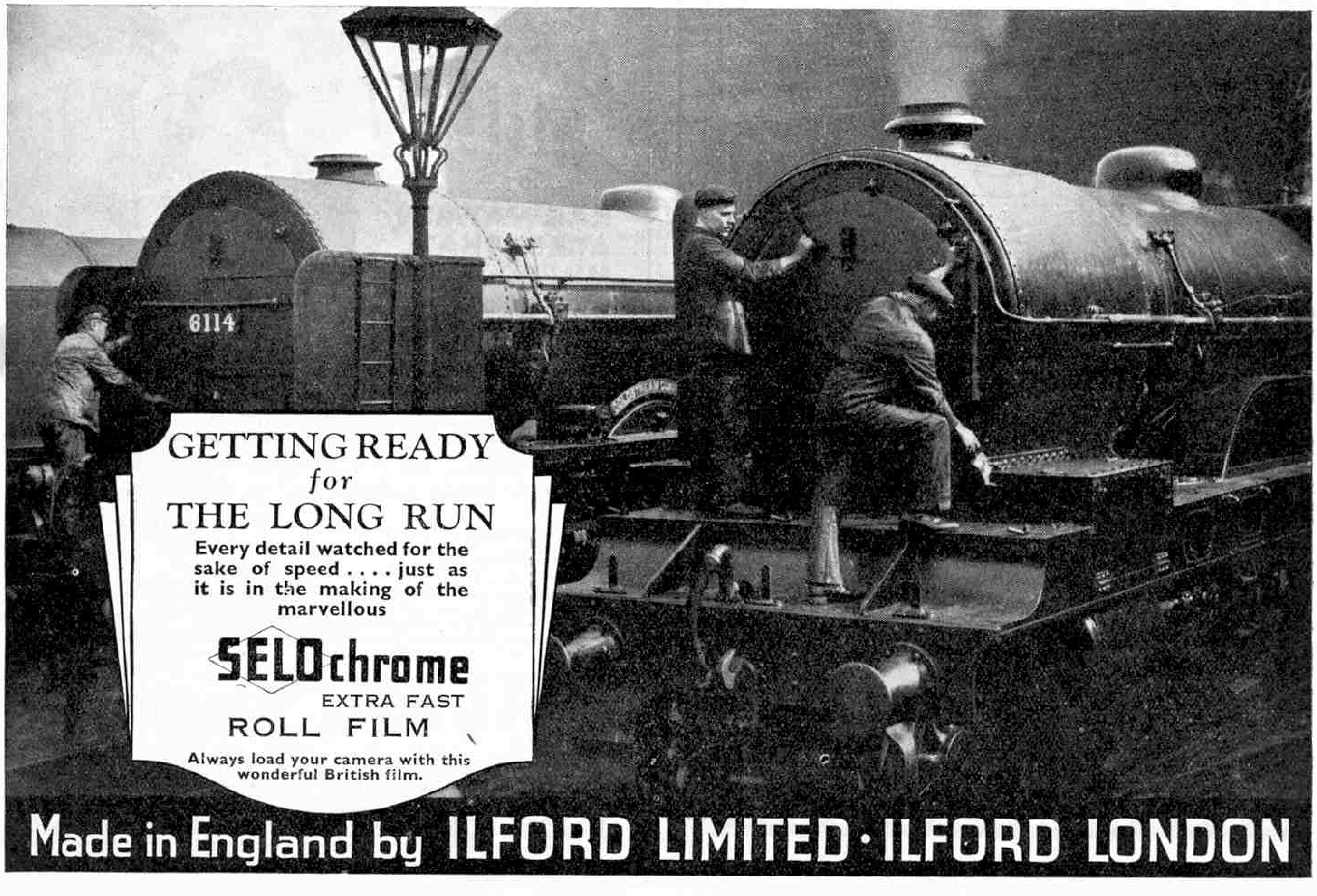

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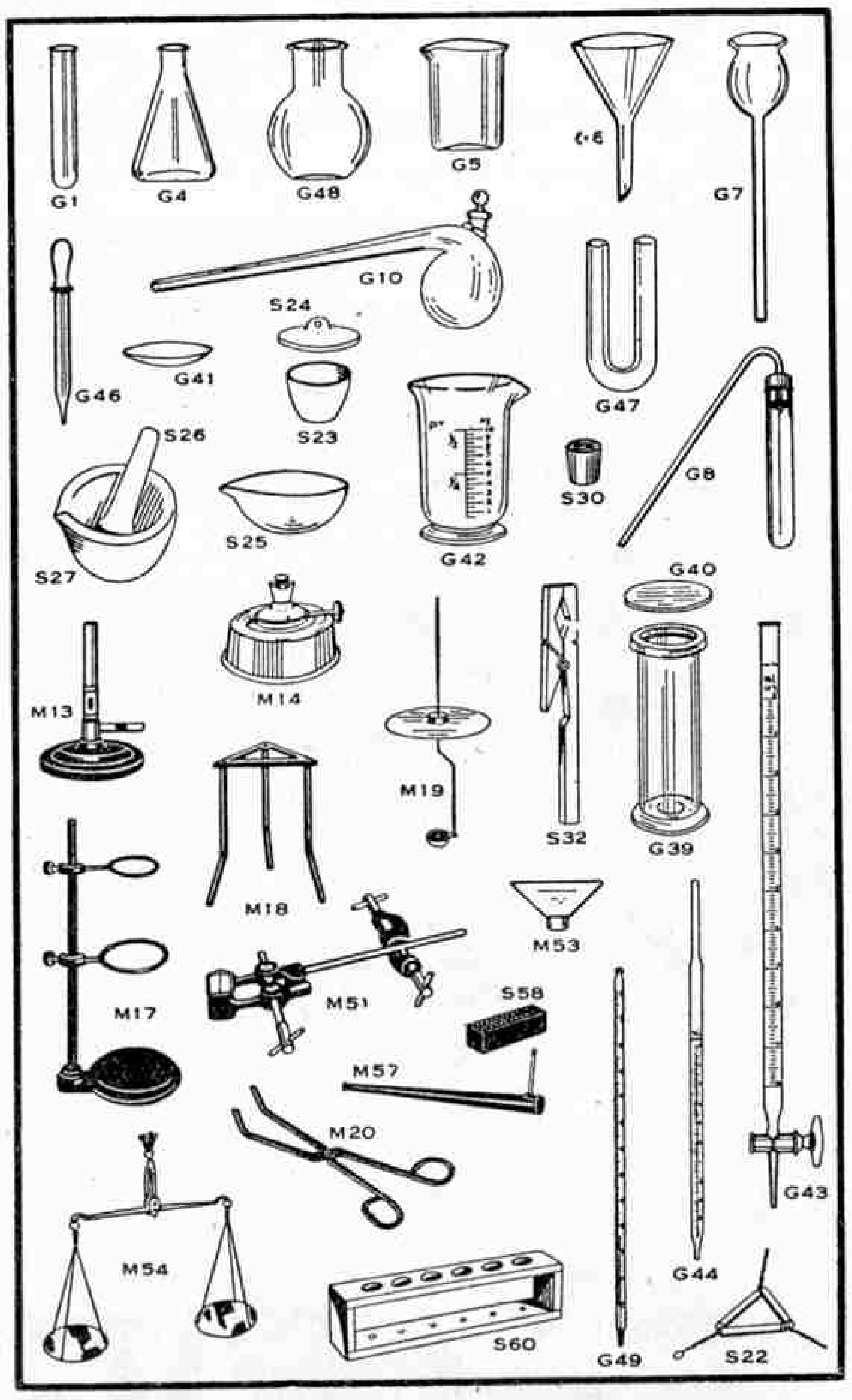

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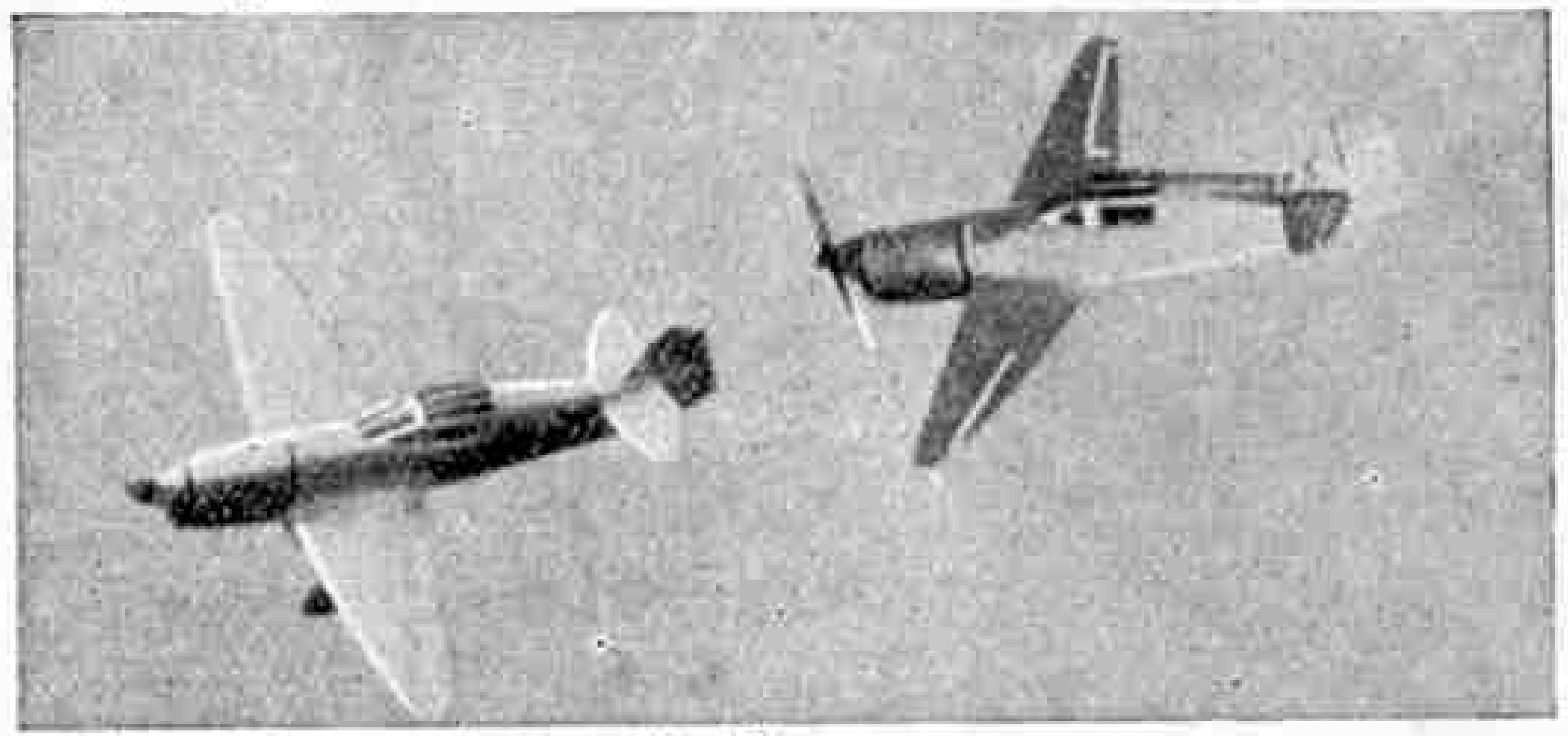

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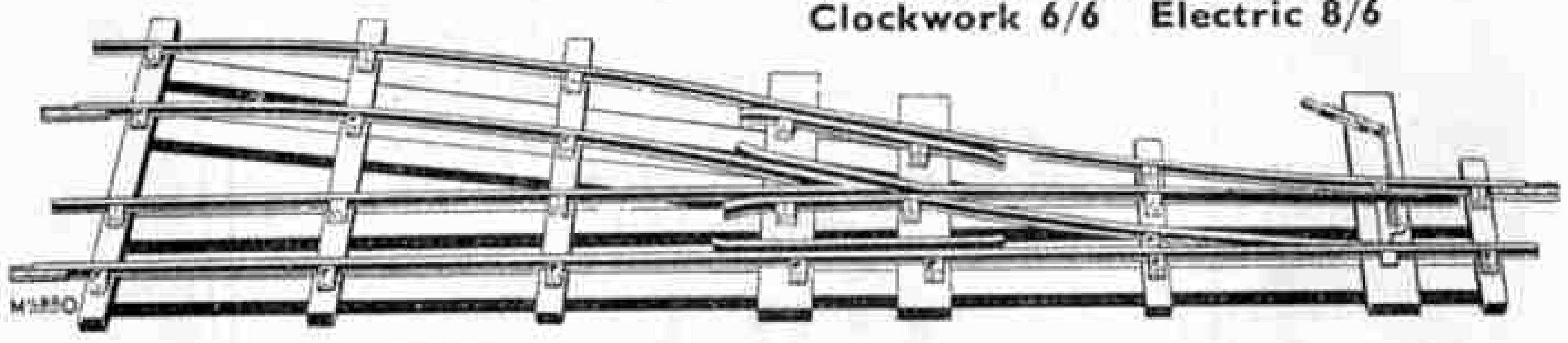

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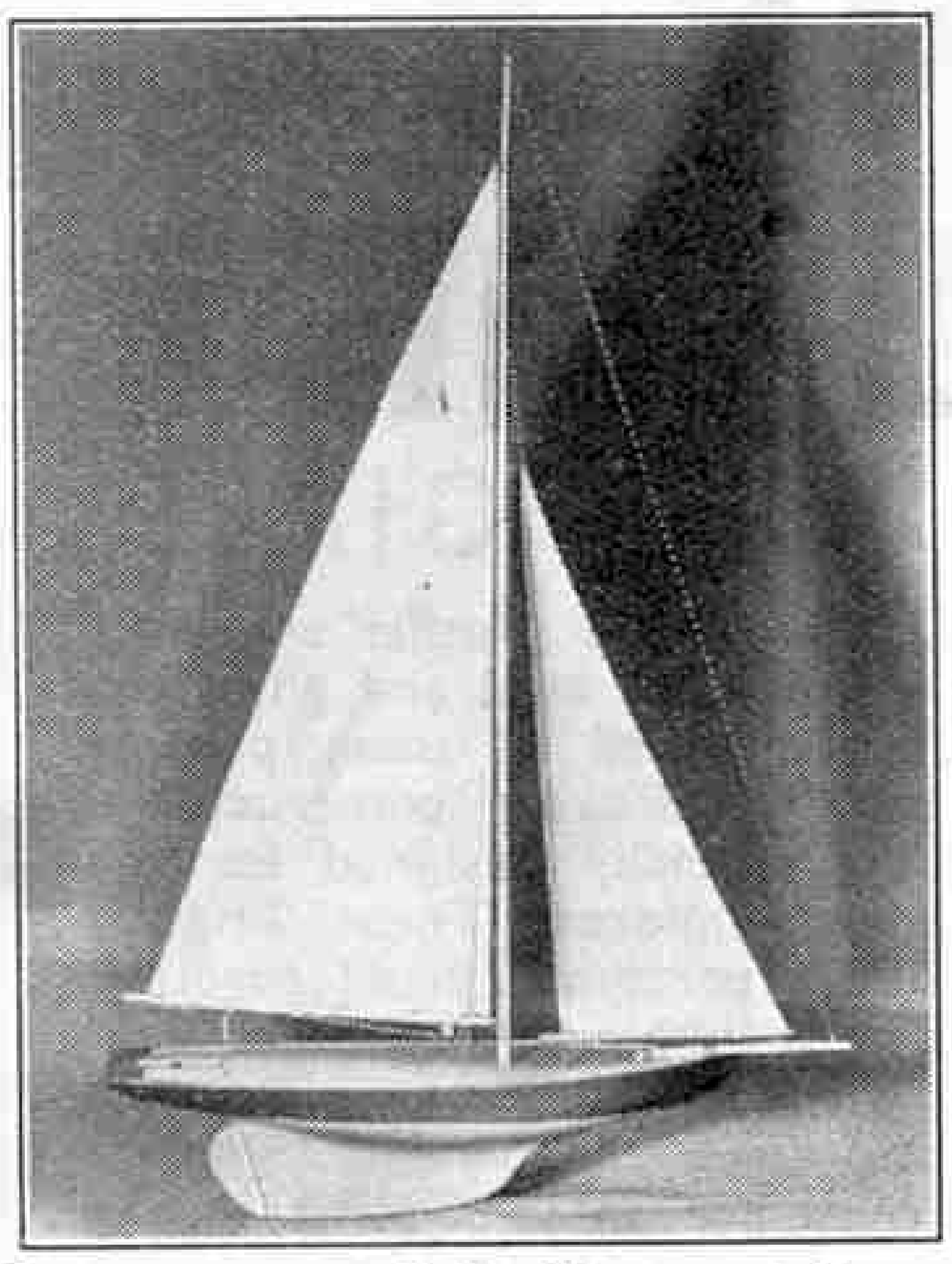

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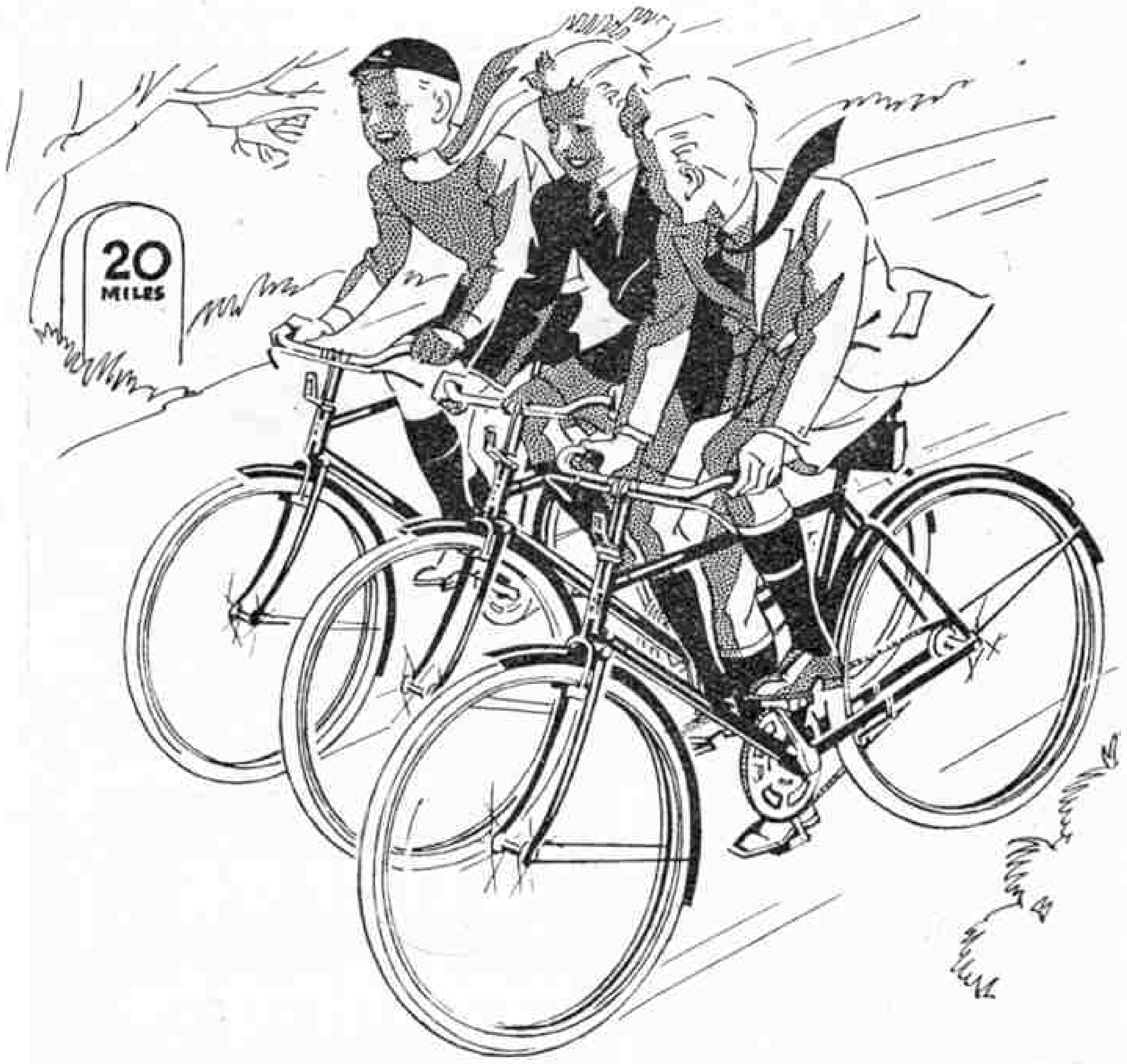

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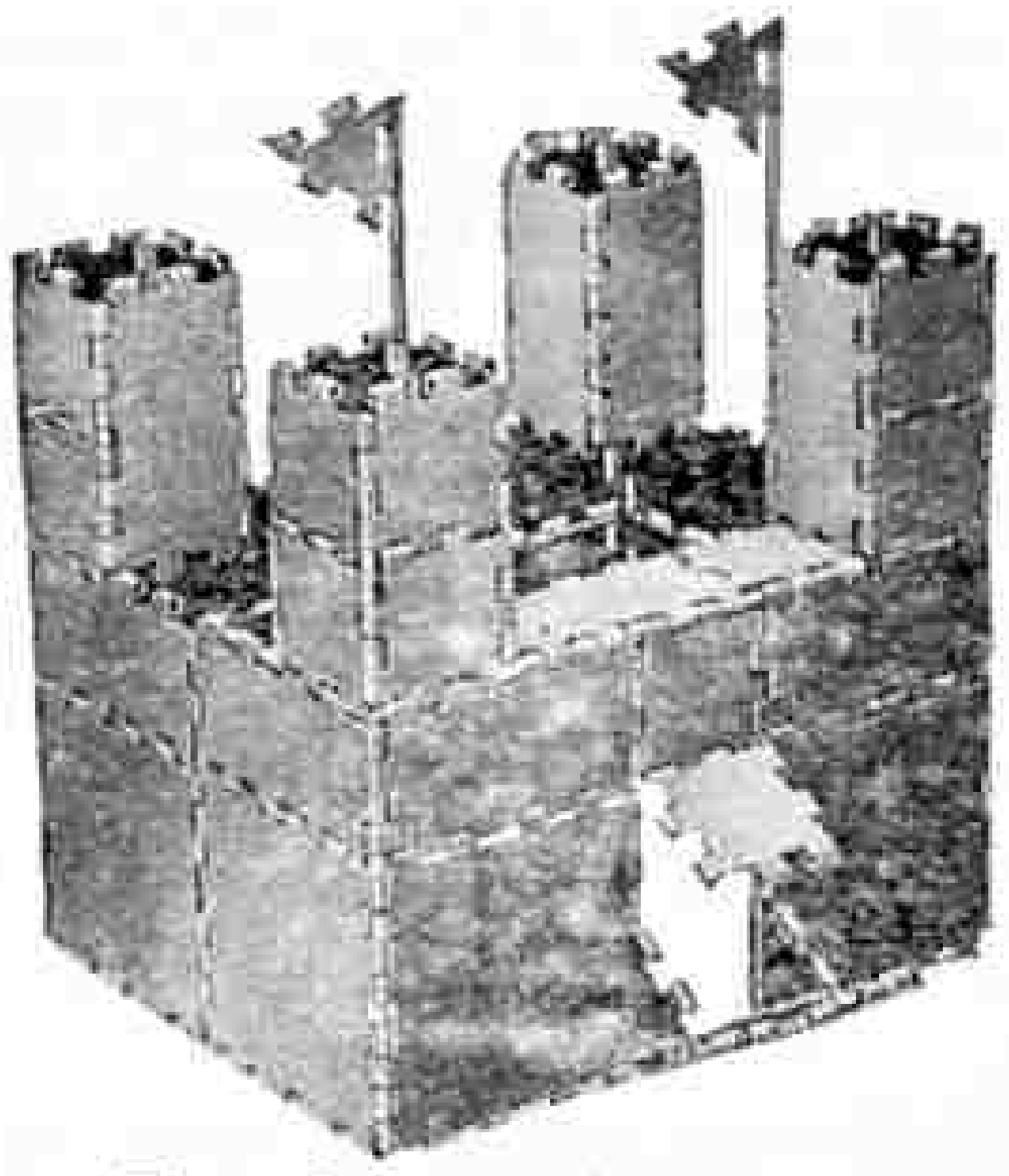
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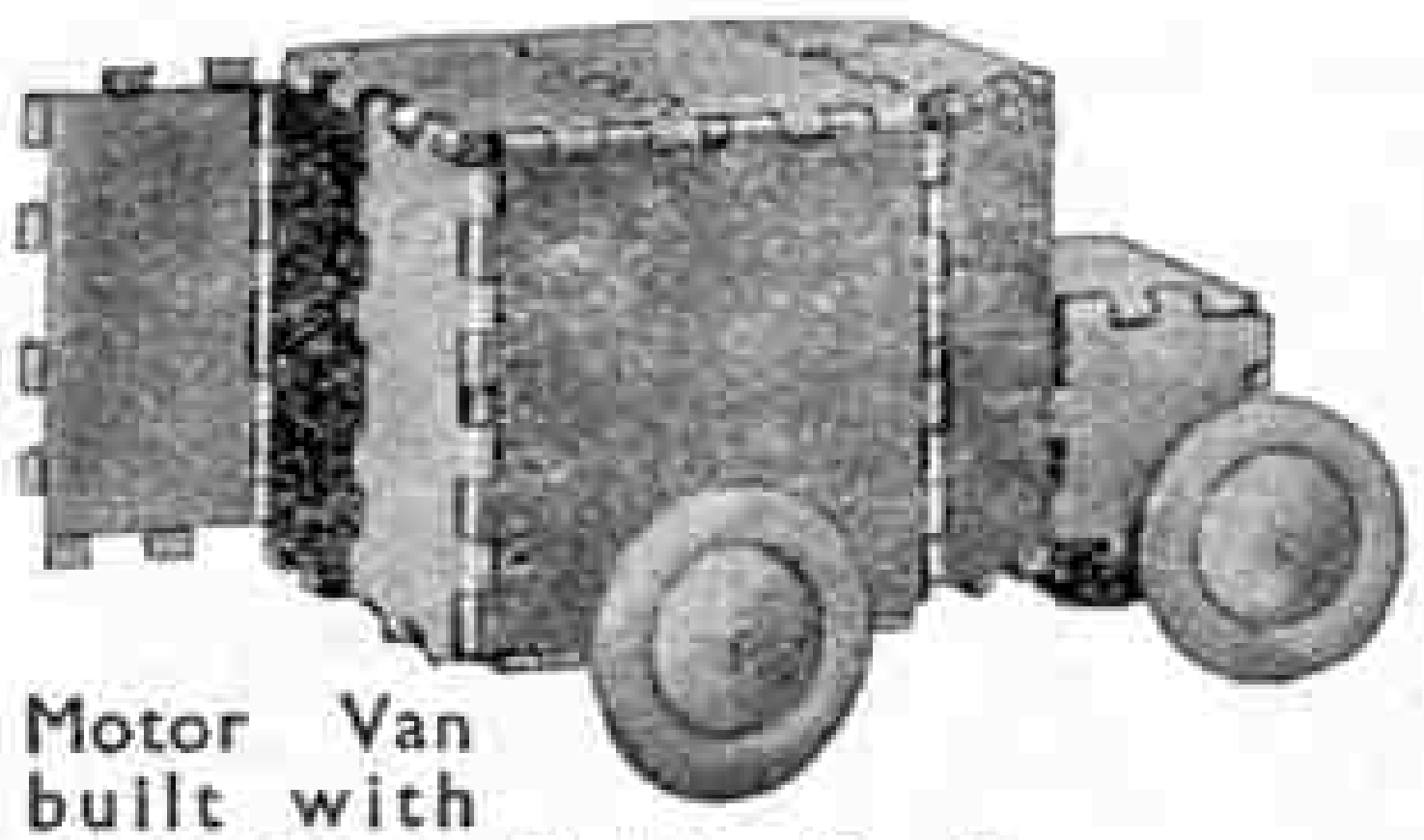
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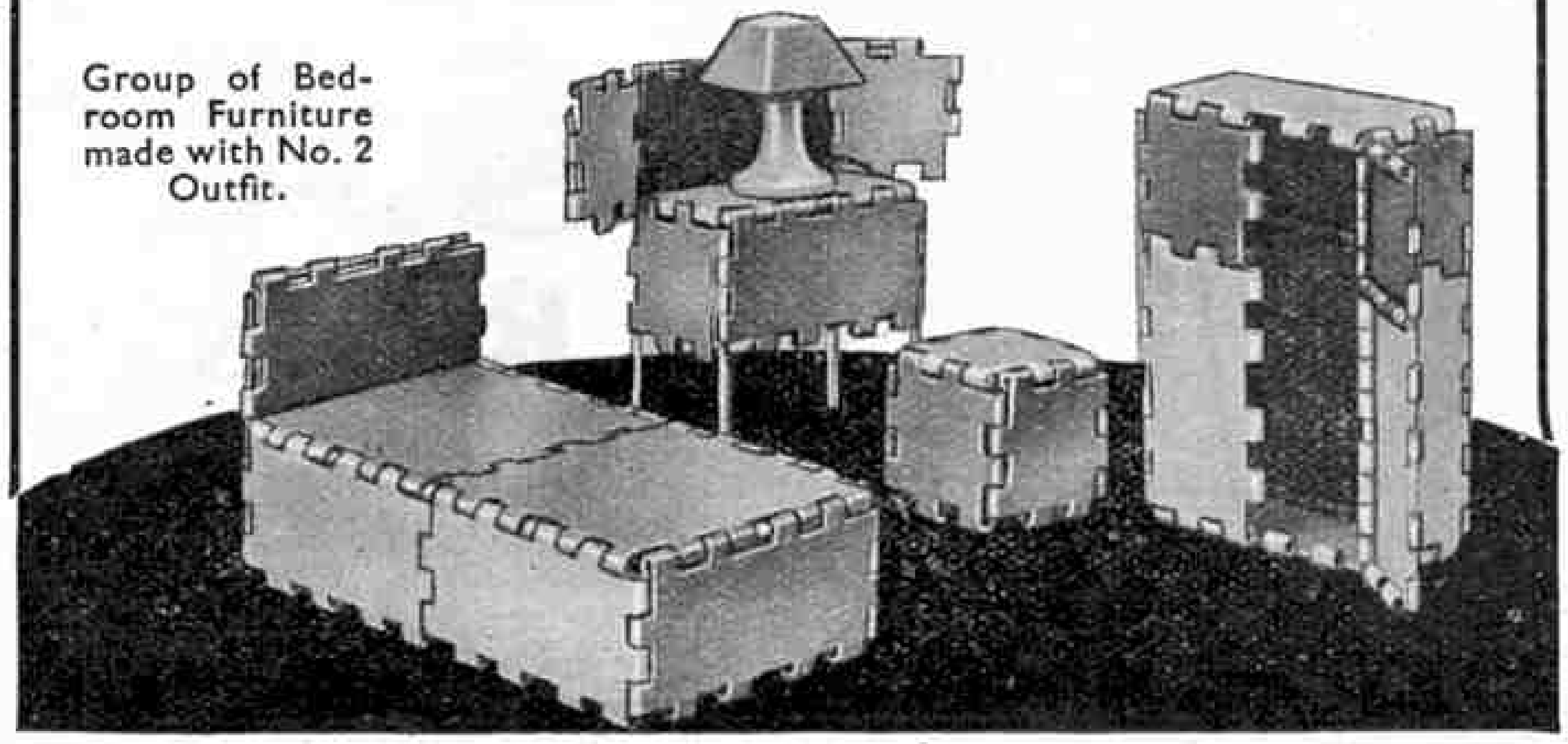
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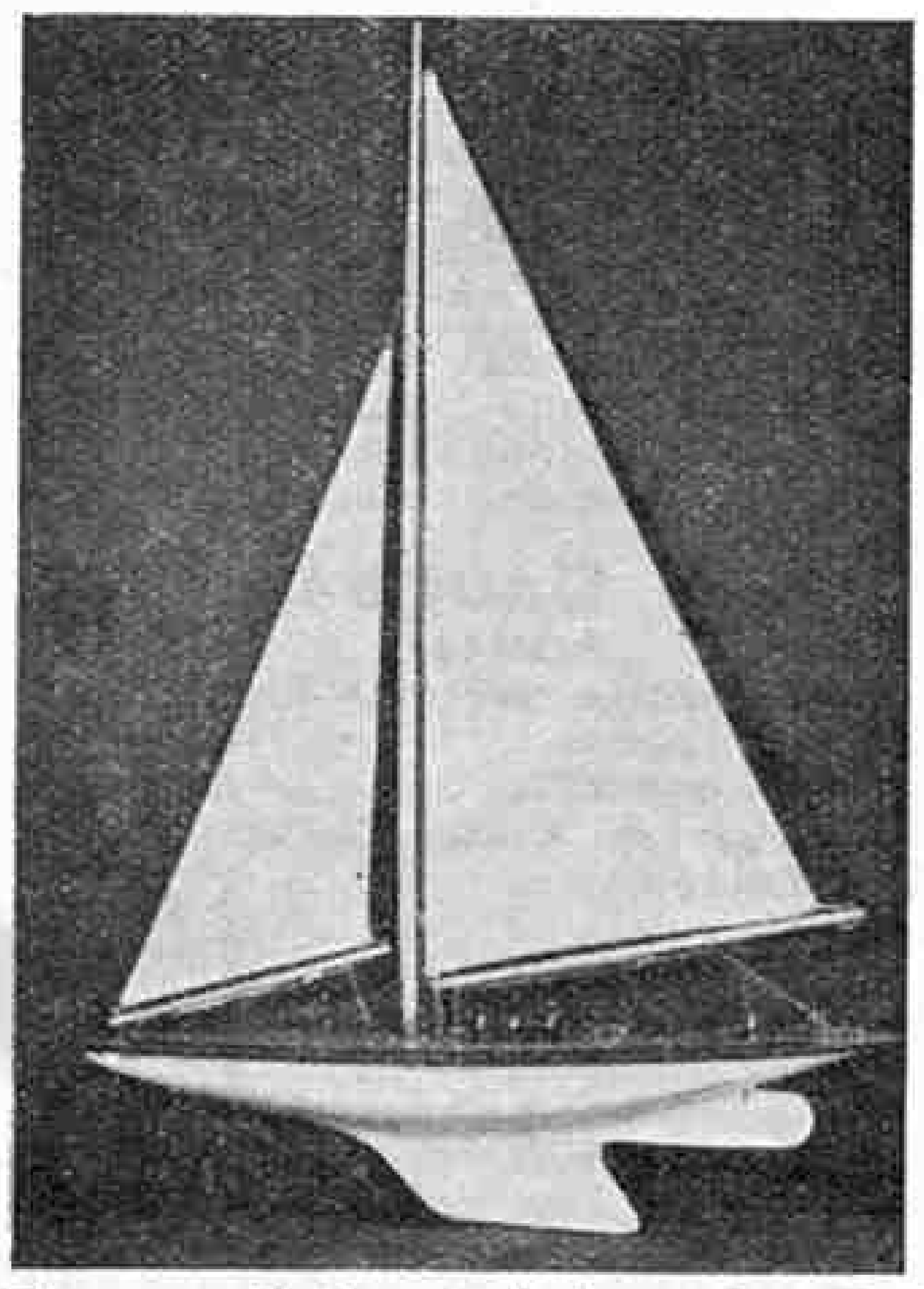

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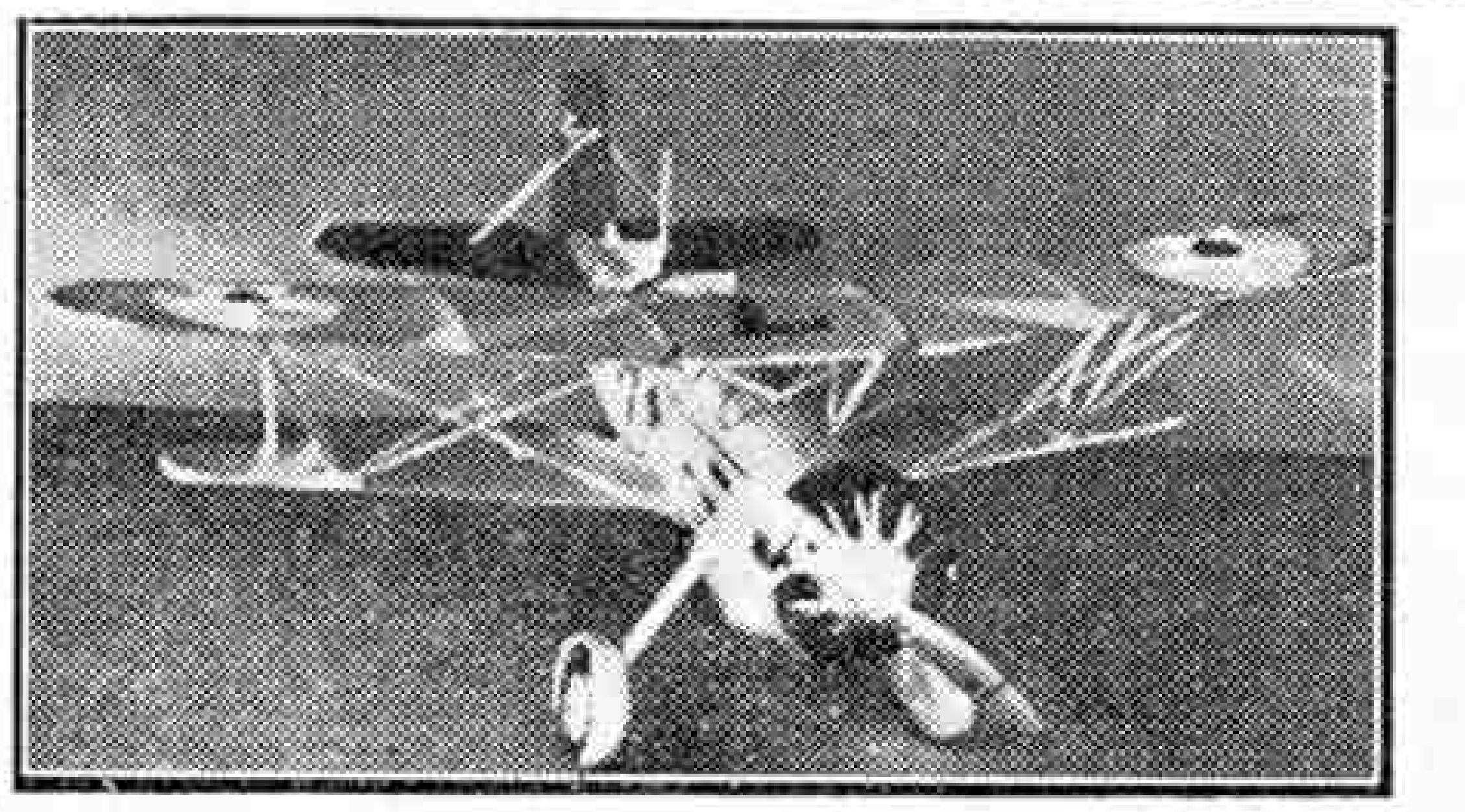

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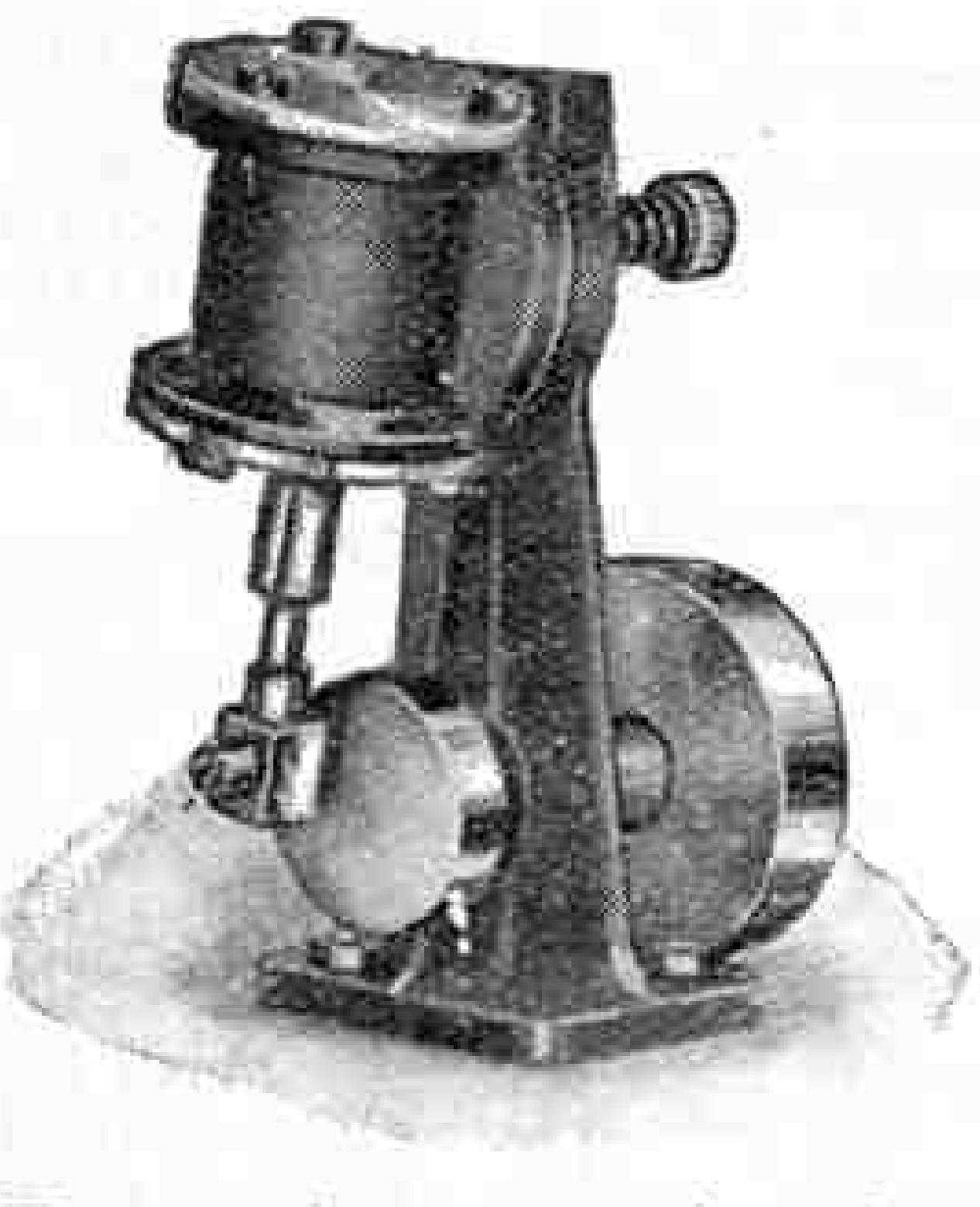

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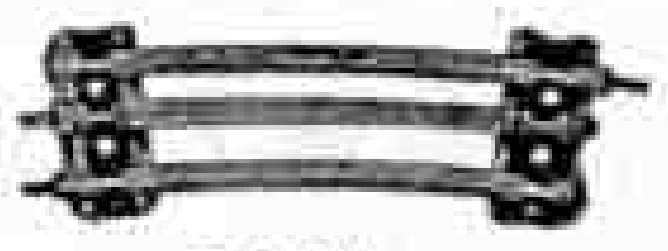
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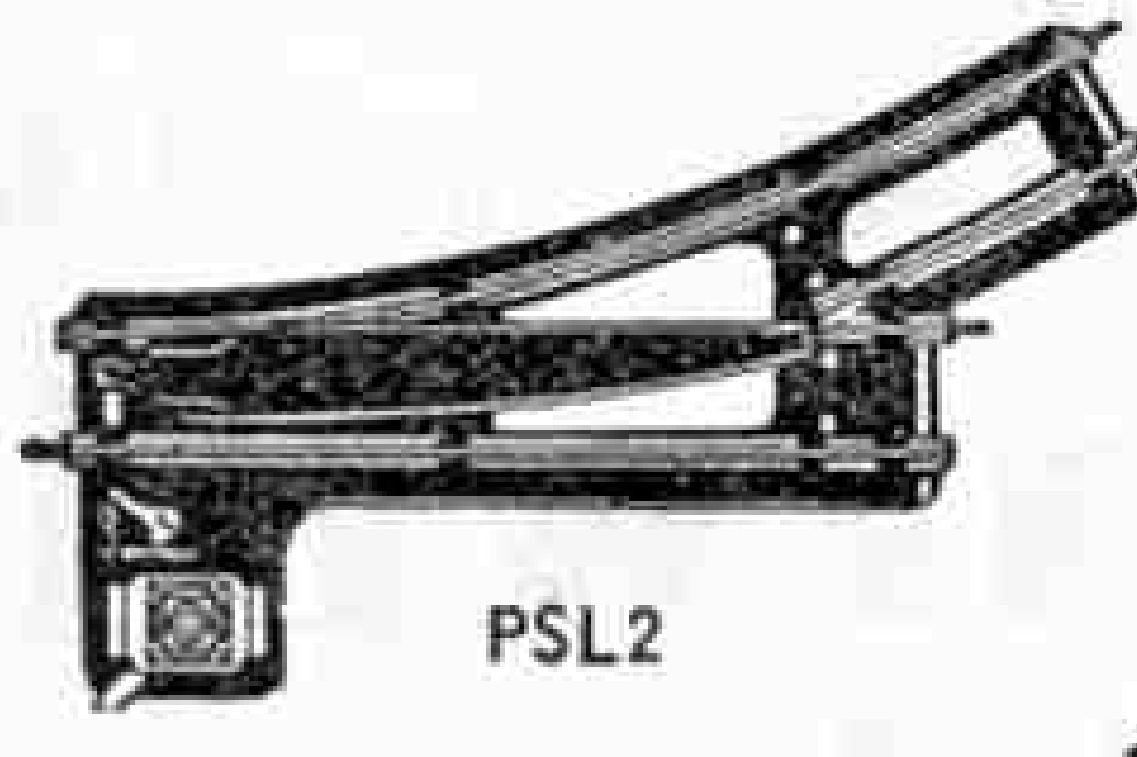
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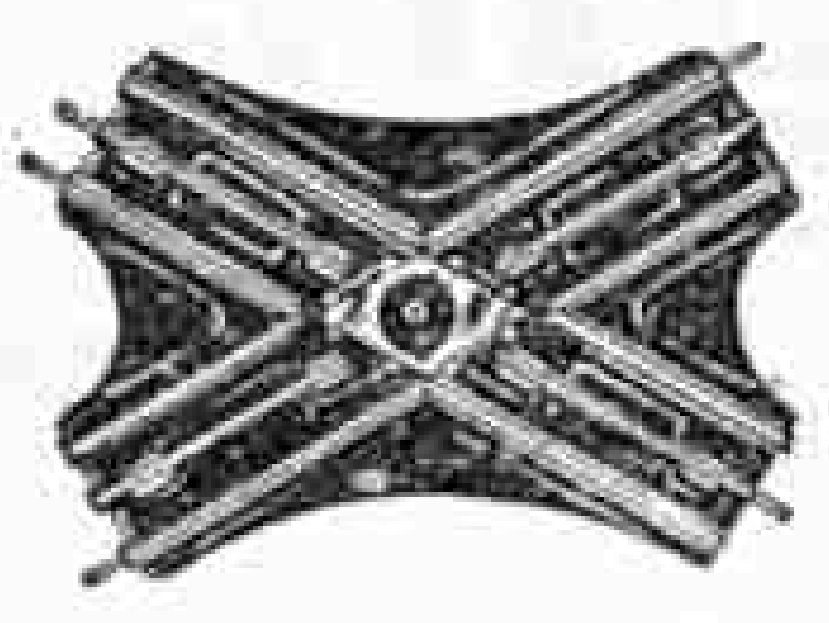
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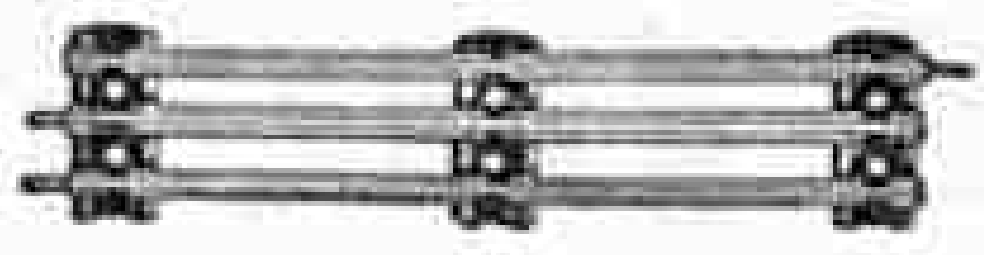
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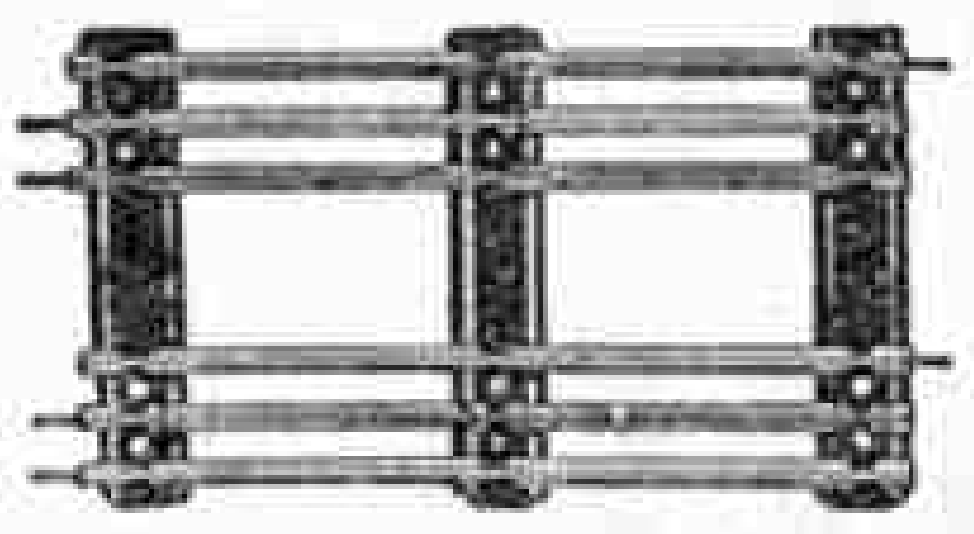
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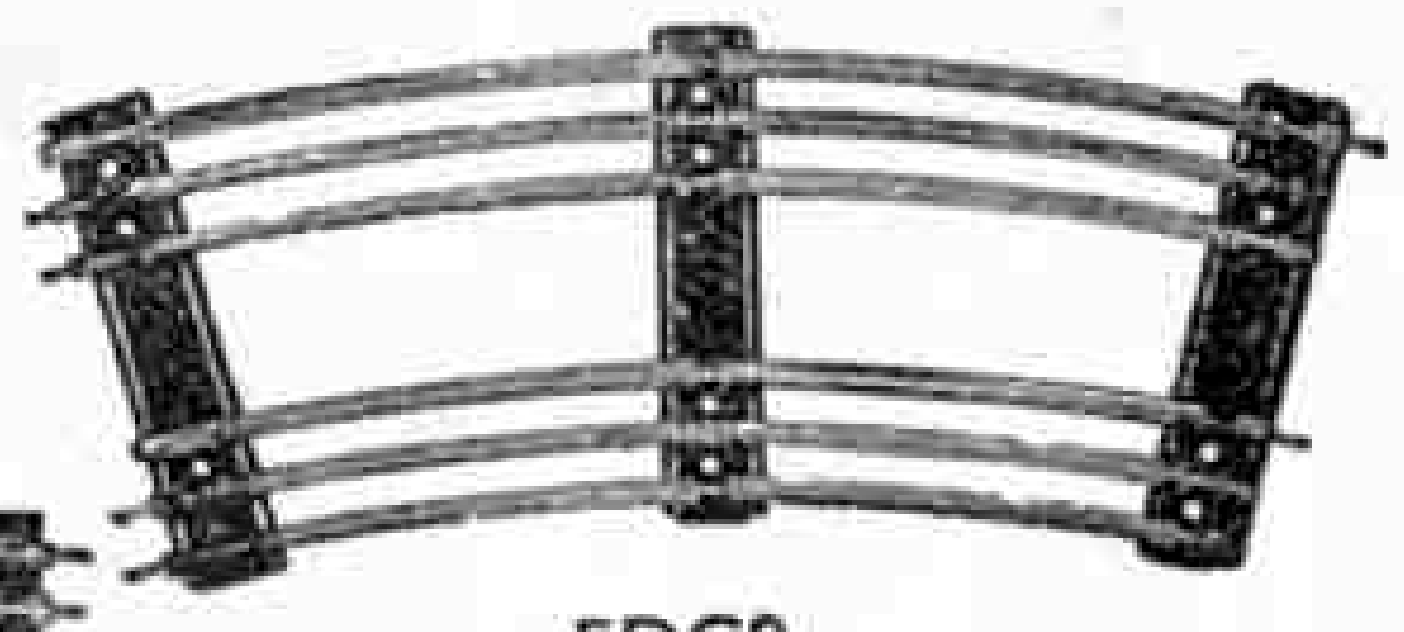
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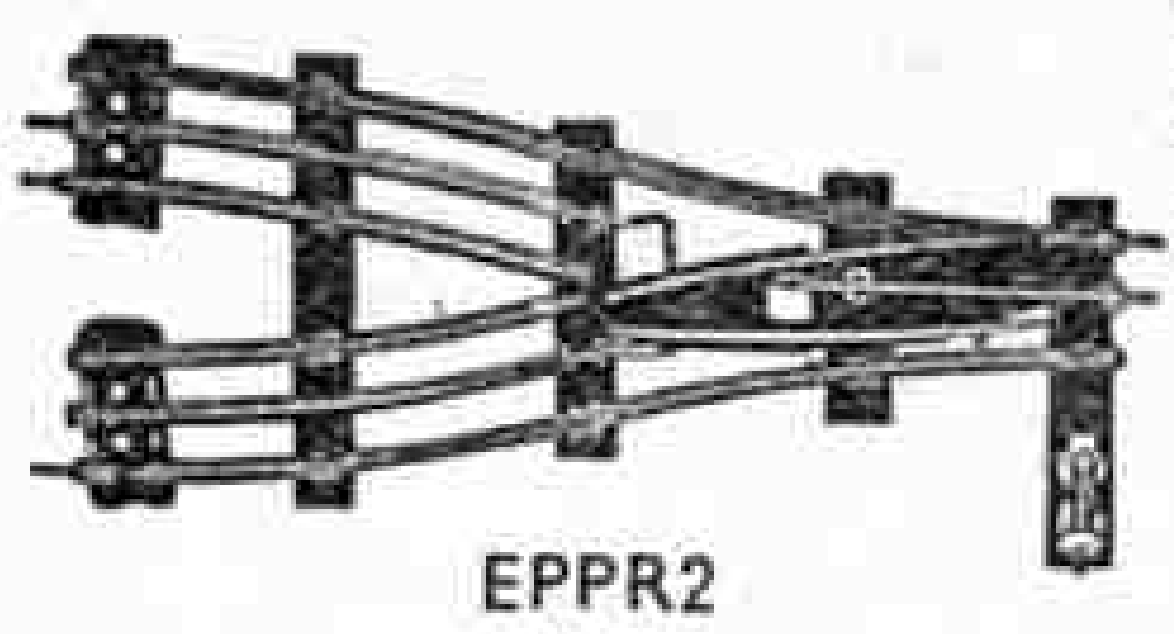
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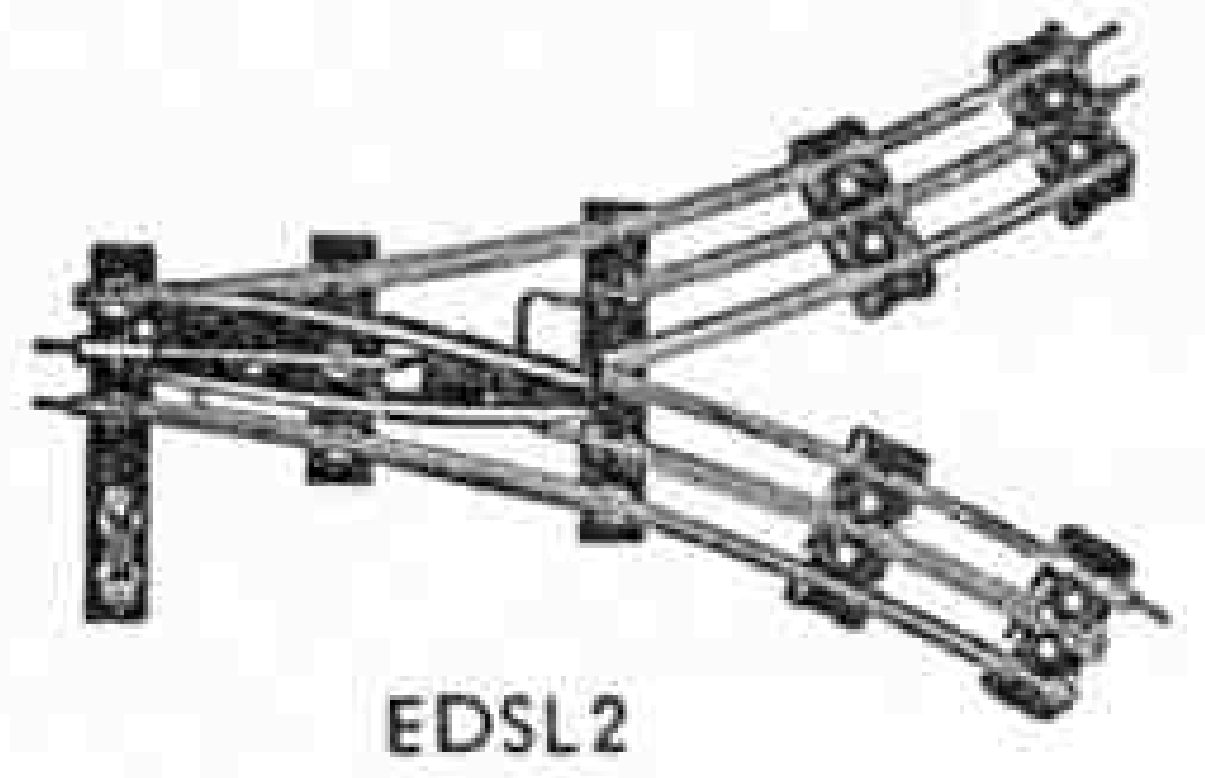
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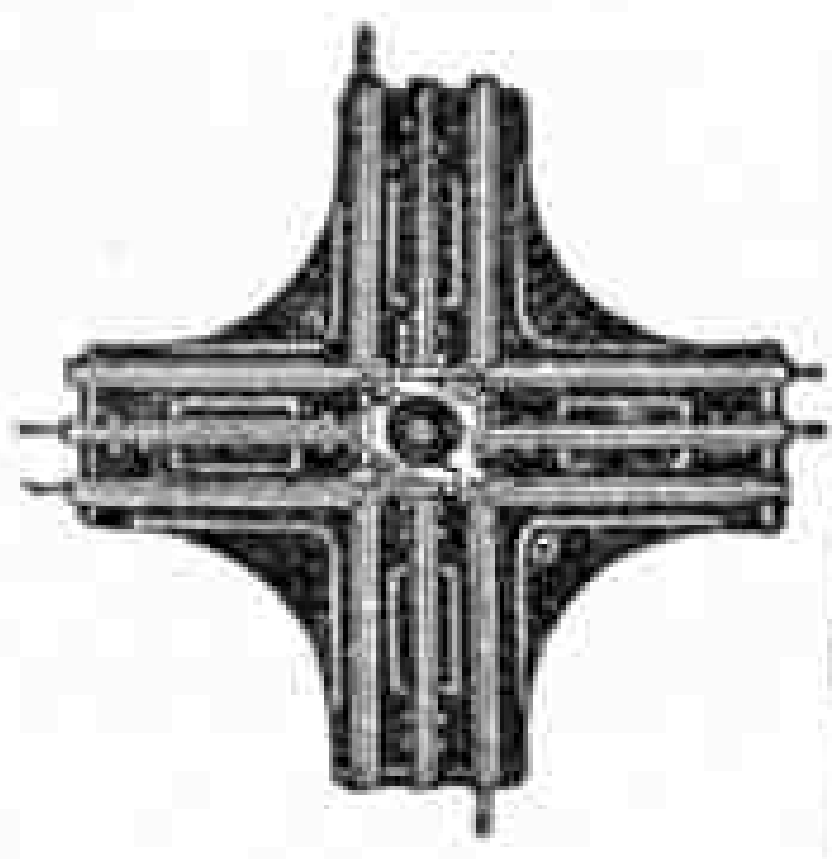
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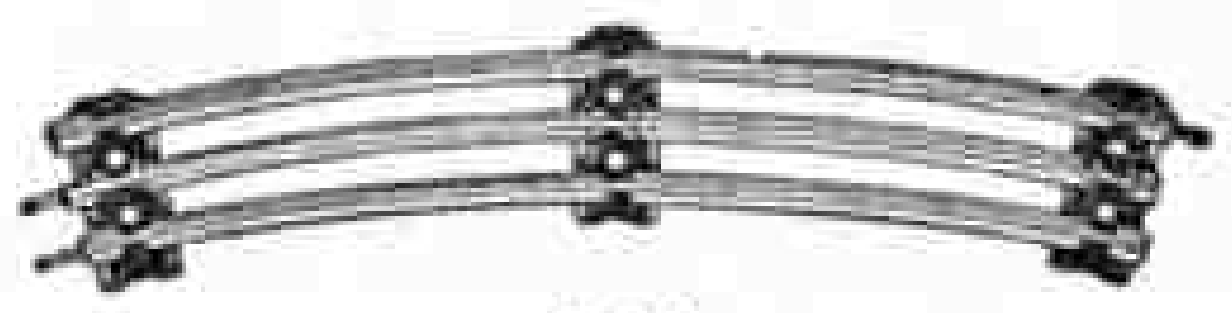
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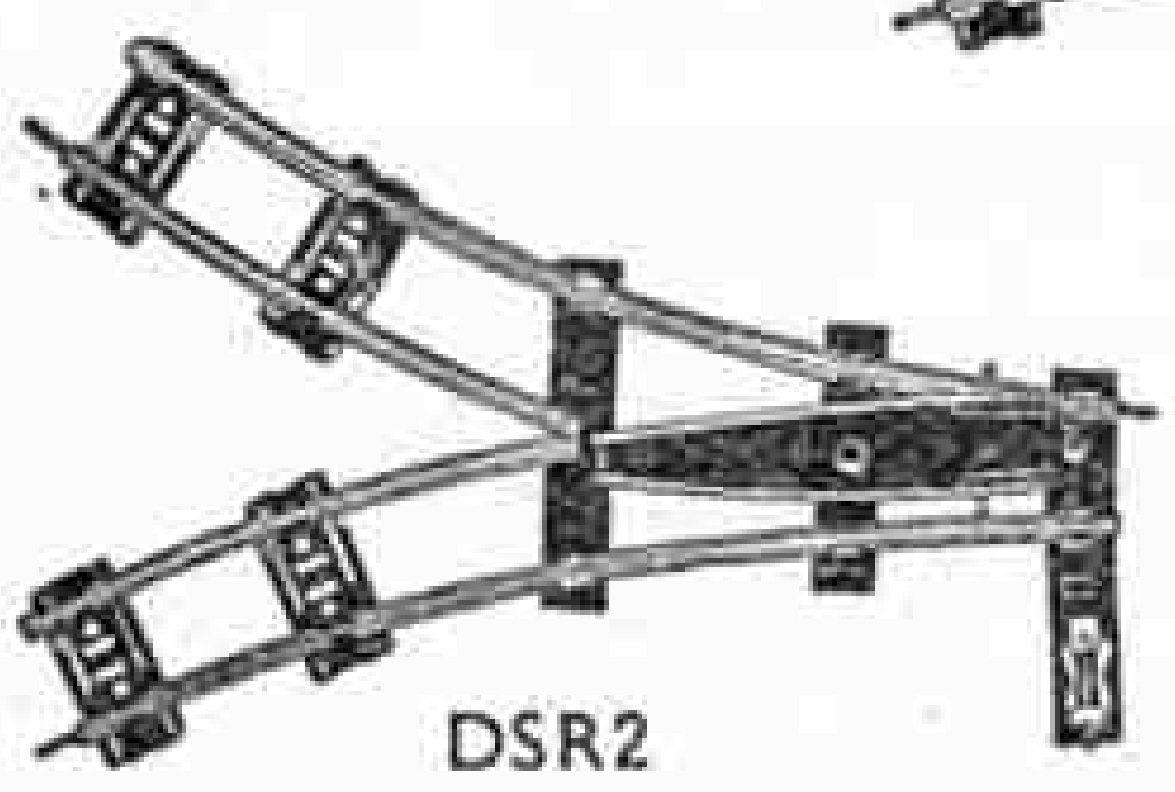
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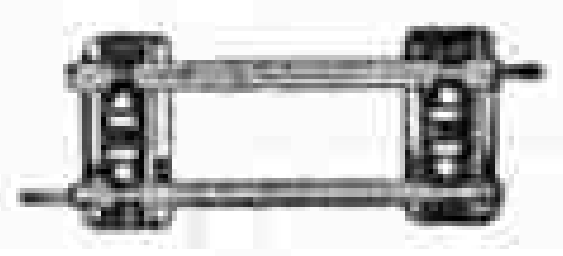
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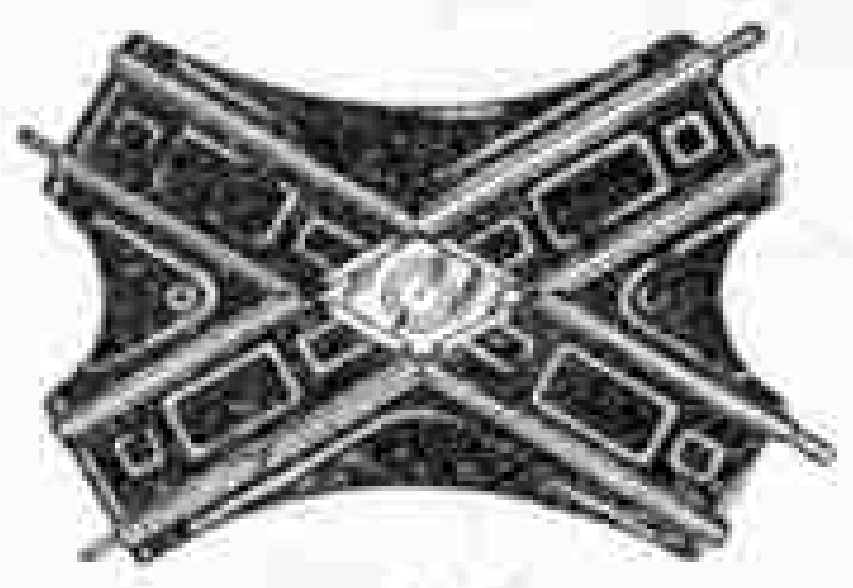
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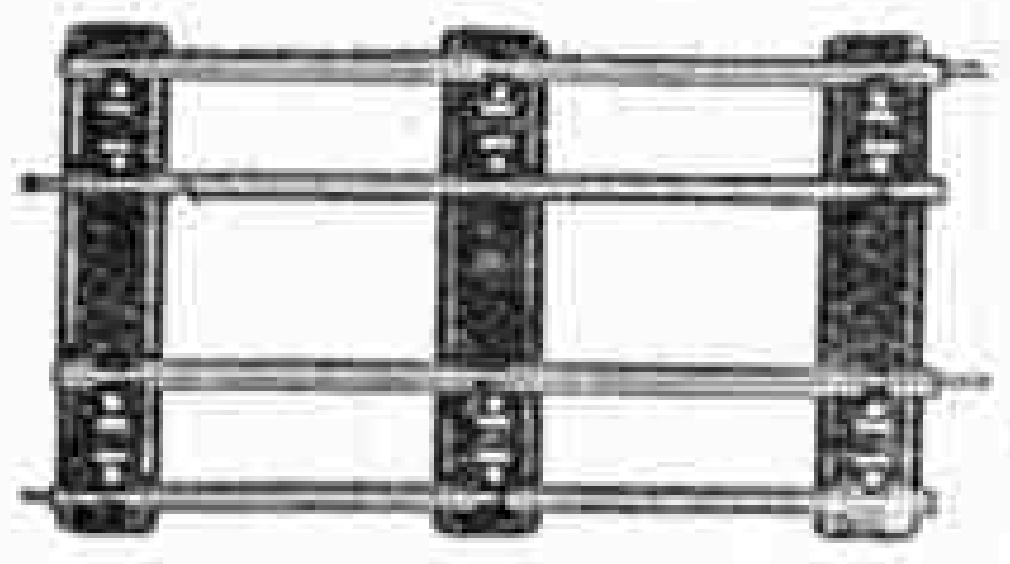
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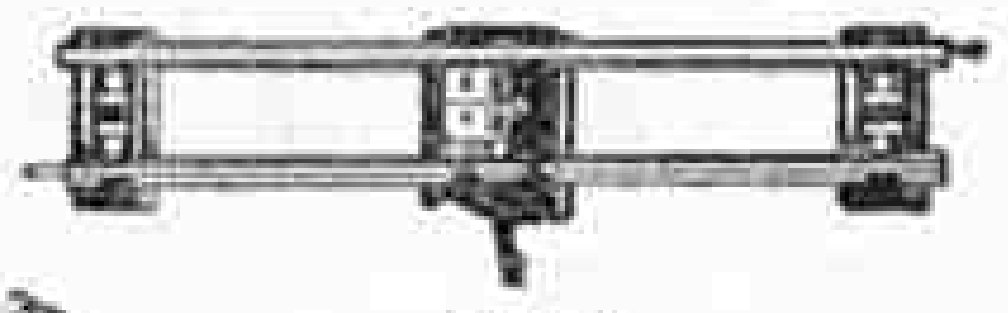
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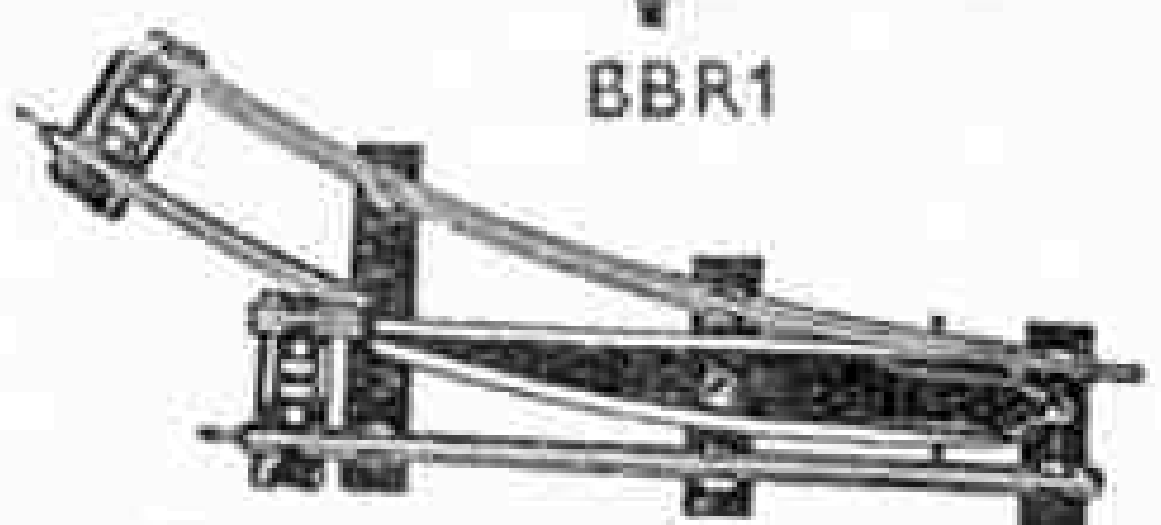
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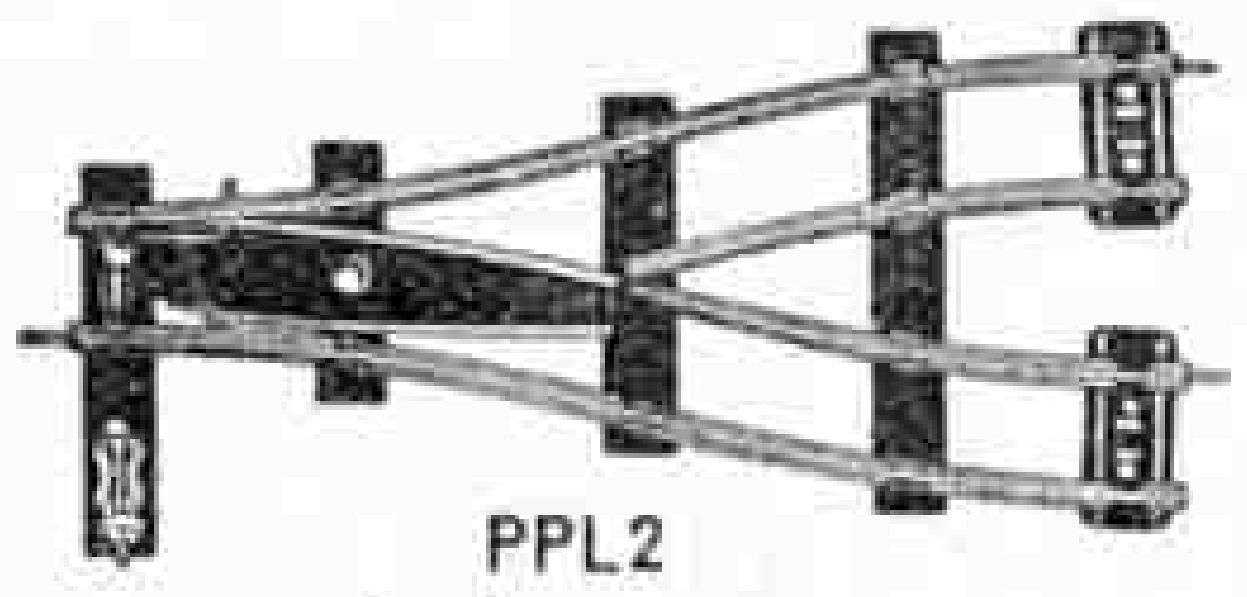
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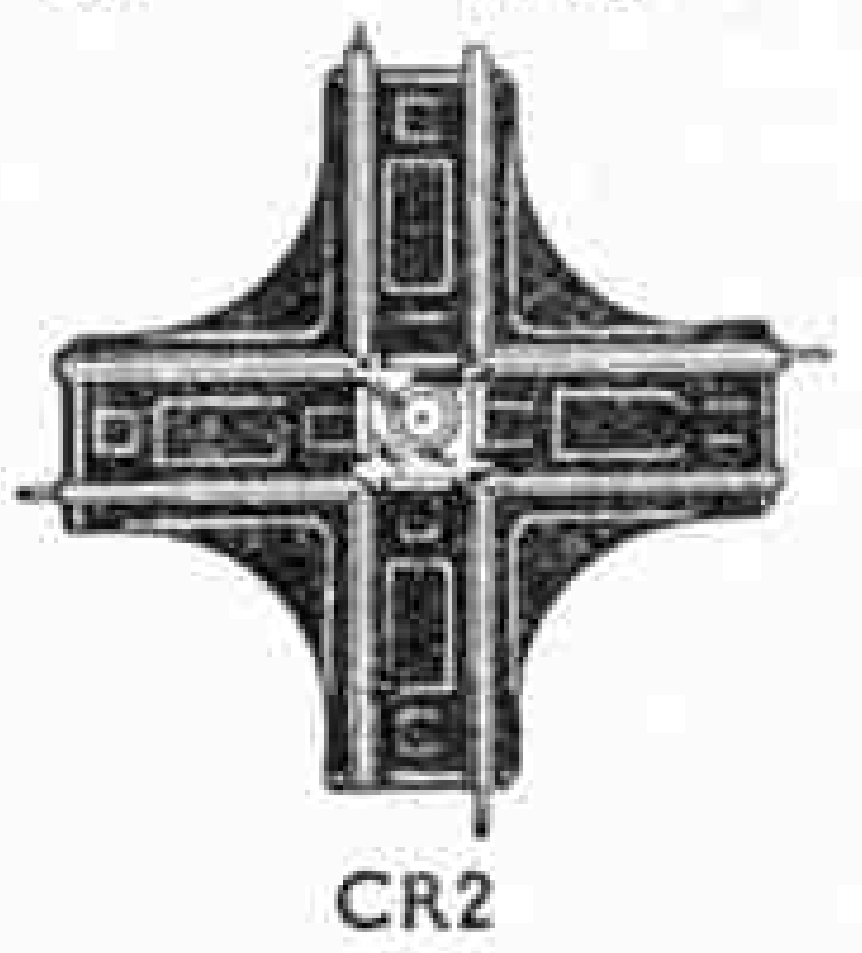
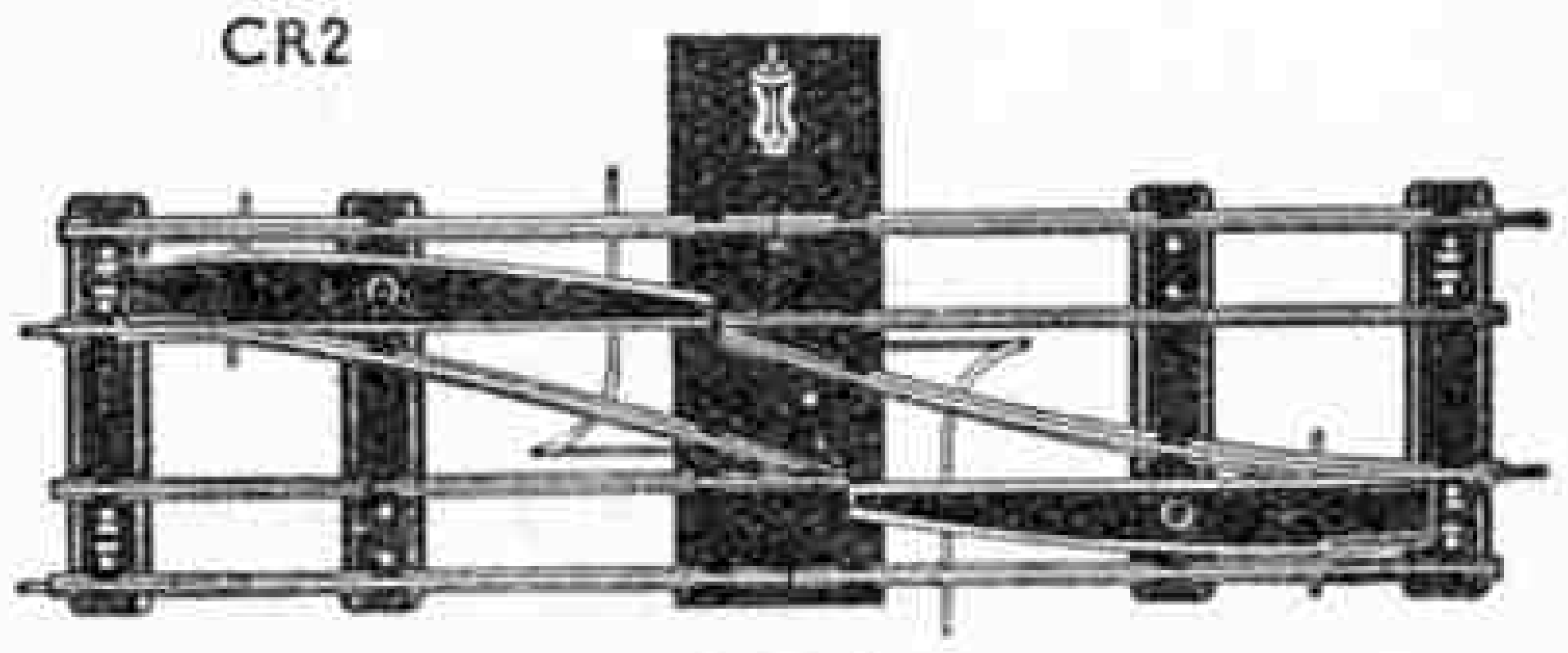
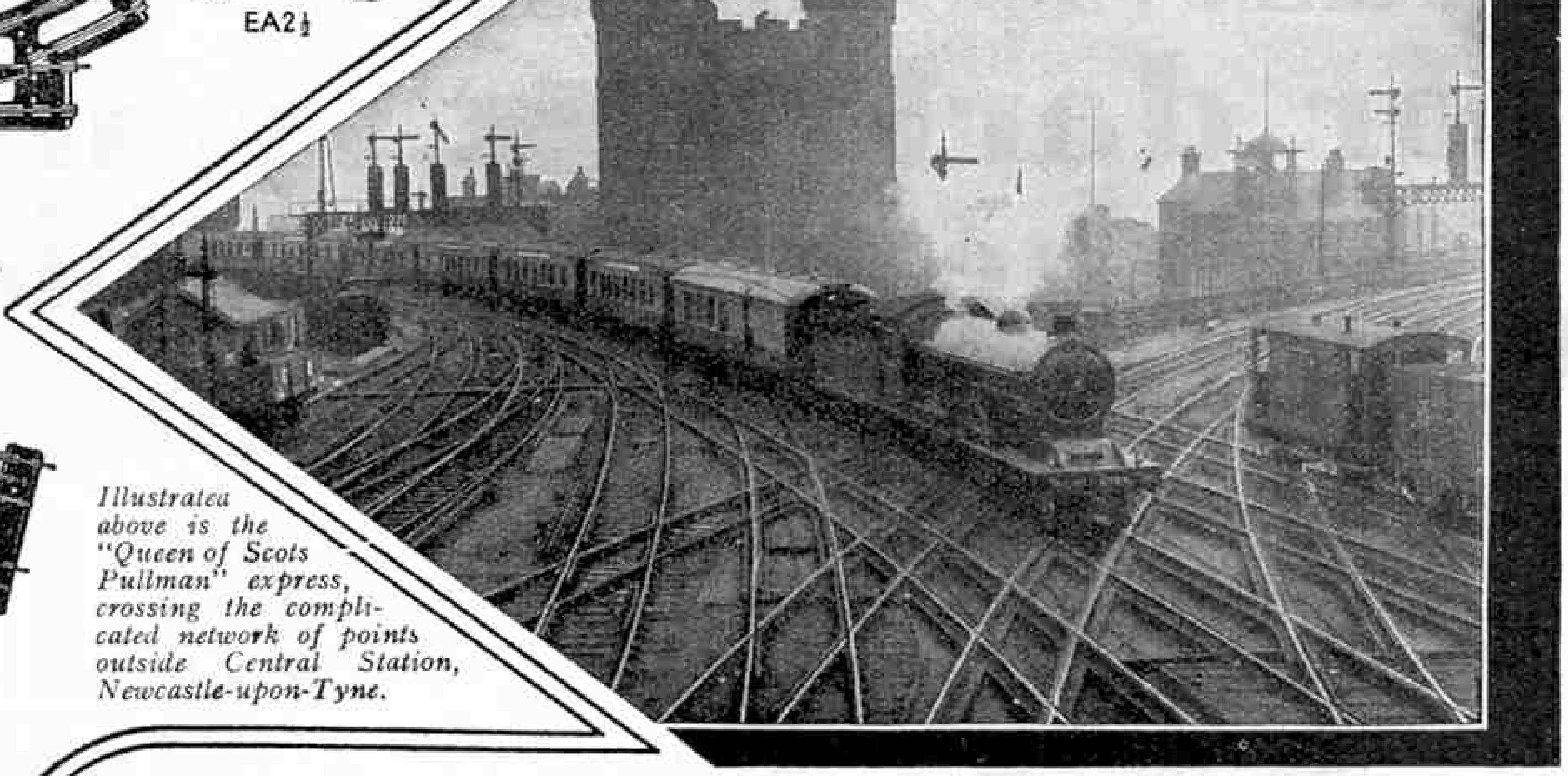

CR2

B1


COR2


Illustrated above is the "Queen of Scots Pullman" express, crossing the complicated network of points outside Central Station, Newcastle-upon-Tyne.

There is practically no limit to the number of rail formations that can be built with Hornby Rails, Points and Crossings. A supply of Rails is included in every Hornby Train Set, but the owner is certainly not getting the best out of his set if he is satisfied with merely running it round a simple oval track. The addition of extra Rails and of Points and Crossings to his equipment lends a delightful realism to the game and greatly enhances the fun.

Rails for Electric Trains, Gauge 0, 1¼″

CURVED RAILS

1-ft. Radius

EA1	Curved rails	per doz.	5/-
EA1½	Curved half rails	,,	4/6
EA1¼	Curved quarter rails	,,	4/-

2-ft. Radius

EA2	Curved rails	per doz.	5/-
EA2½	Curved half rails	,,	4/6
EA2¼	Curved quarter rails	,,	4/-
EDC2	Curved rails, double track ...	½ doz.	9/-

STRAIGHT RAILS

EB1	Straight rails	per doz.	5/-
EB½	Straight half rails	,,	4/6
EB¼	Straight quarter rails	,,	4/-
EDS1	Straight rails, double track ...	½ doz.	8/6

POINTS

For 1-ft. Radius Curves

EPR1	Right-hand points	per pair	5/9
EPL1	Left-hand points		

For 2-ft. Radius Curves

ESPSR2	Right-hand points	per pair	7/6
ESPSL2	Left-hand points		

CROSSINGS

ECA	Acute-angle crossings	each	2/9
ECR	Right-angle crossings	,,	2/9

DOUBLE SYMMETRICAL POINTS

For 1-ft. Radius Curves

EDSR1	Double symmetrical points, right-hand,	per pair	6/-
EDSL1	Double symmetrical points, left-hand,		

For 2-ft. Radius Curves

EDSR2	Double symmetrical points, right-hand,	per pair	7/-
EDSL2	Double symmetrical points, left-hand,		

PARALLEL POINTS

EPPR2	Parallel points, right-hand	per pair	7/-
EPPL2	Parallel points, left-hand		

CROSSOVER POINTS

ECOR2	Crossover points, right-hand	per pair	24/-
ECOL2	Crossover points, left-hand		

EMC20	Switch rail (20-volt)	each	1/3
EMC6	Switch rail (6-volt)	,,	1/3
TCP20	Terminal connecting plates (20-volt)	,,	1/3
TCP6	Terminal connecting plates (6-volt)	,,	1/3

Rails for Clockwork and Steam Trains, Gauge 0, 1¼″

CURVED RAILS

M9	Curved rails (9-in. Radius) ...	per doz.	2/6
MB9	Curved brake rails	each	3d.
A1	Curved rails (1-ft. Radius) ...	per doz.	3/6
A1½	Curved half rails ,, ...	,,	3/-
A1¼	Curved quarter rails ,, ...	,,	2/6
AB1	Curved brake rails ,, ...	each	4d.
A2	Curved rails (2-ft. Radius) ...	per doz.	3/6
A2½	Curved half rails ,, ...	,,	3/-
A2¼	Curved quarter rails ,, ...	,,	2/6
AB2	Curved brake rails ,, ...	each	5d.
DC2	Curved rails, double track,, ...	½ doz.	6/-

STRAIGHT RAILS

BM	Straight rails (for MO Trains) ...	per doz.	2/6
B1	Straight rails	,,	3/6
B½	Straight half rails	,,	3/-
B¼	Straight quarter rails	,,	2/6
BB1	Straight brake rails	each	4d.
BBR1	Straight brake and reverse rails...	,,	1/6
DS1	Straight rails, double track ...	½ doz.	5/3

CROSSINGS

CA1	Acute-angle crossings (for 1-ft. radius track)	each	1/9
CA2	Acute-angle crossings (for 2-ft. radius track)	,,	1/6
CR1	Right-angle crossings (for 1-ft. radius track)	,,	1/9
CR2	Right-angle crossings (for 2-ft. radius track)	,,	1/6

POINTS

9-in. Radius (for MO Trains)

MR9	Right-hand points	per pair	3/-
ML9	Left-hand points		

For 1-ft. Radius Curves

PR1	Right-hand points	per pair	3/-
PL1	Left-hand points		

For 2-ft. Radius Curves

PR2	Right-hand points	per pair	3/-
PL2	Left-hand points		
PSR2	Points on solid base, right-hand	per pair	8/6
PSL2	Points on solid base, left-hand		
SPSR2	Points on solid base, right-hand	per pair	5/-
SPSL2	Points on solid base, left-hand		

These points are similar to Points PSR2 and PSL2 but they are not fitted with ground disc or for Hornby Control.

PARALLEL POINTS

PPR2	Parallel points, right-hand	per pair	3/6
PPL2	Parallel points, left-hand		

DOUBLE SYMMETRICAL POINTS

For 1-ft. Radius Curves

DSR1	Double sym. points, right-hand	per pair	3/6
DSL1	Double sym. points, left-hand		

For 2-ft. Radius Curves

DSR2	Double sym. points, right-hand	per pair	3/6
DSL2	Double sym. points, left-hand		

CROSSOVER POINTS

COR2	Crossover points, right-hand	per pair	12/-
COL2	Crossover points, left-hand		
RCP	Rail connecting plates	½ doz.	2d.

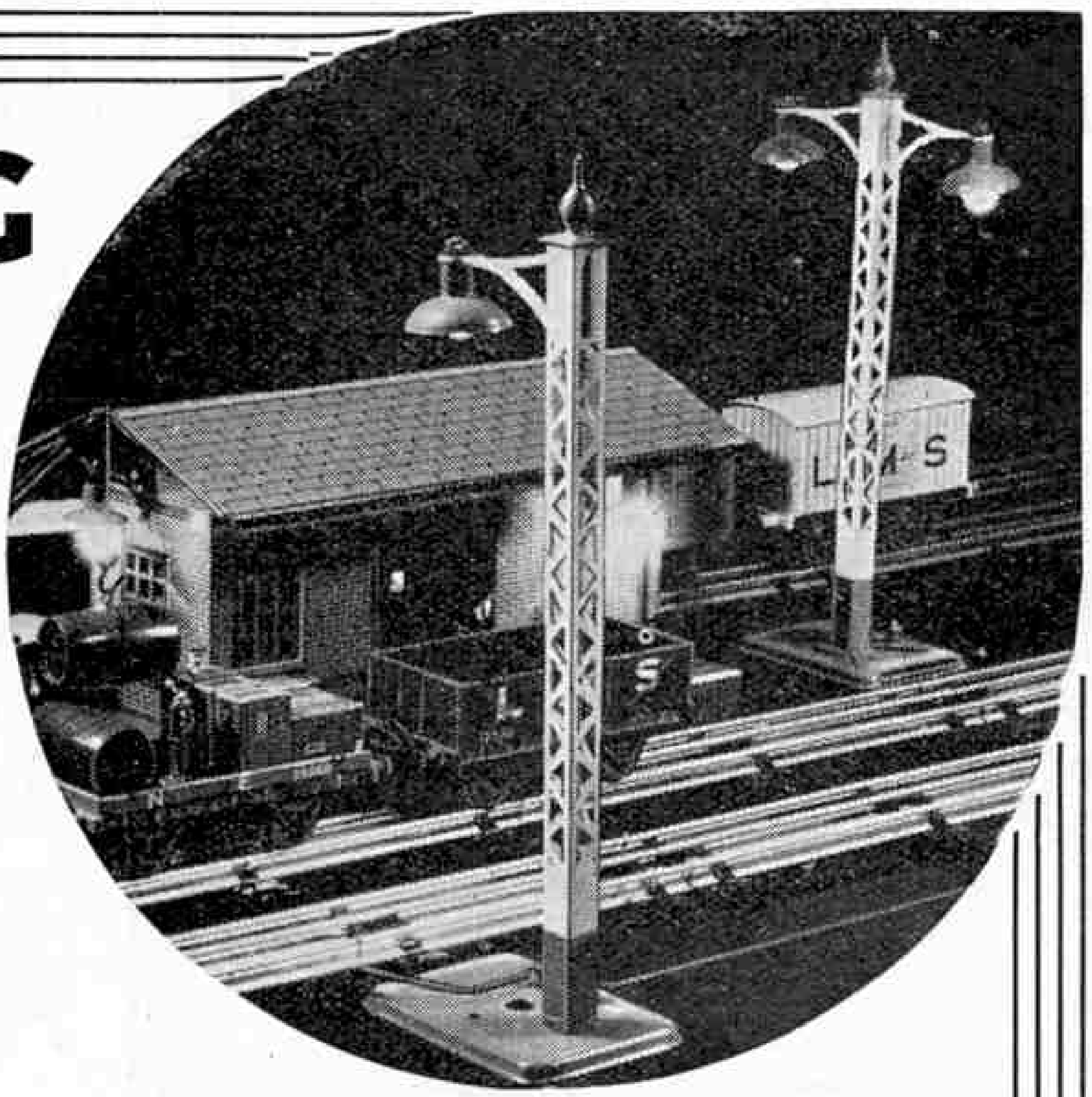
Many interesting illustrations and much useful information regarding Hornby Railway layouts are given in the booklets "How to plan your Hornby Railway," and "Hornby Layouts—100 Suggestions." Each of these booklets is obtainable from your dealer, price 3d., or from Meccano Ltd., Binns Road, Liverpool 13, price 4d. post free.

MECCANO LTD., LIVERPOOL 13

ELECTRIC LIGHTING SYSTEM FOR HORNBY ACCESSORIES

BRILLIANT, SAFE AND INEXPENSIVE

The following is a complete list of the Hornby Accessories available fitted for electric lighting. These accessories are specially designed for lighting from the 3½-volt circuit of a Meccano T20A or T6A Transformer, and with each of these Transformers are packed for the purpose a pair of Plugs, an Earthing Clip and a coil of Wire, together with full instructions. The Accessories can also be lighted from an accumulator. Each Accessory is accompanied by an Earthing Clip and a Leaflet giving full instructions for use. Lamp bulbs are not provided with the Accessories.



This illustration of a scene on a Hornby layout, shows the striking effects obtainable with the Hornby Electric Lighting System.

No. E1E Engine Shed	Price 15/6	No. 2E Signal Gantry	Price 12/9
No. E2E Engine Shed	,, 23/–	No. E1E Level Crossing	,, 5/3
No. 2E Station	,, 9/3	No. E2E Level Crossing	,, 9/–
Island Platform E	,, 6/3	No. 1E Buffer Stops	,, 1/6
No. 2E Goods Platform	,, 11/6	No. 2E Buffer Stops	,, 6/–
No. 2E Signal Cabin	,, 4/3	No. 2E Water Tank	,, 6/6
No. 2E Signal	,, 2/9	No. 1E Lamp Standard	,, 2/11
No. 2E Double Arm Signal ...	,, 3/11	No. 2E Lamp Standard	,, 3/3
No. 2E Junction Signal	,, 6/–		

The following items used in connection with the latest system of Accessories lighting are available:
Plugs for Sockets of Transformers T20A and T6A. Price per pair, 6d. Earthing Clips, each 3d. Connecting Wire. Price per coil, 4d.

ACCESSORIES FOR LIGHTING WITH DISTRIBUTION BOX AND FLEXIBLE LEADS

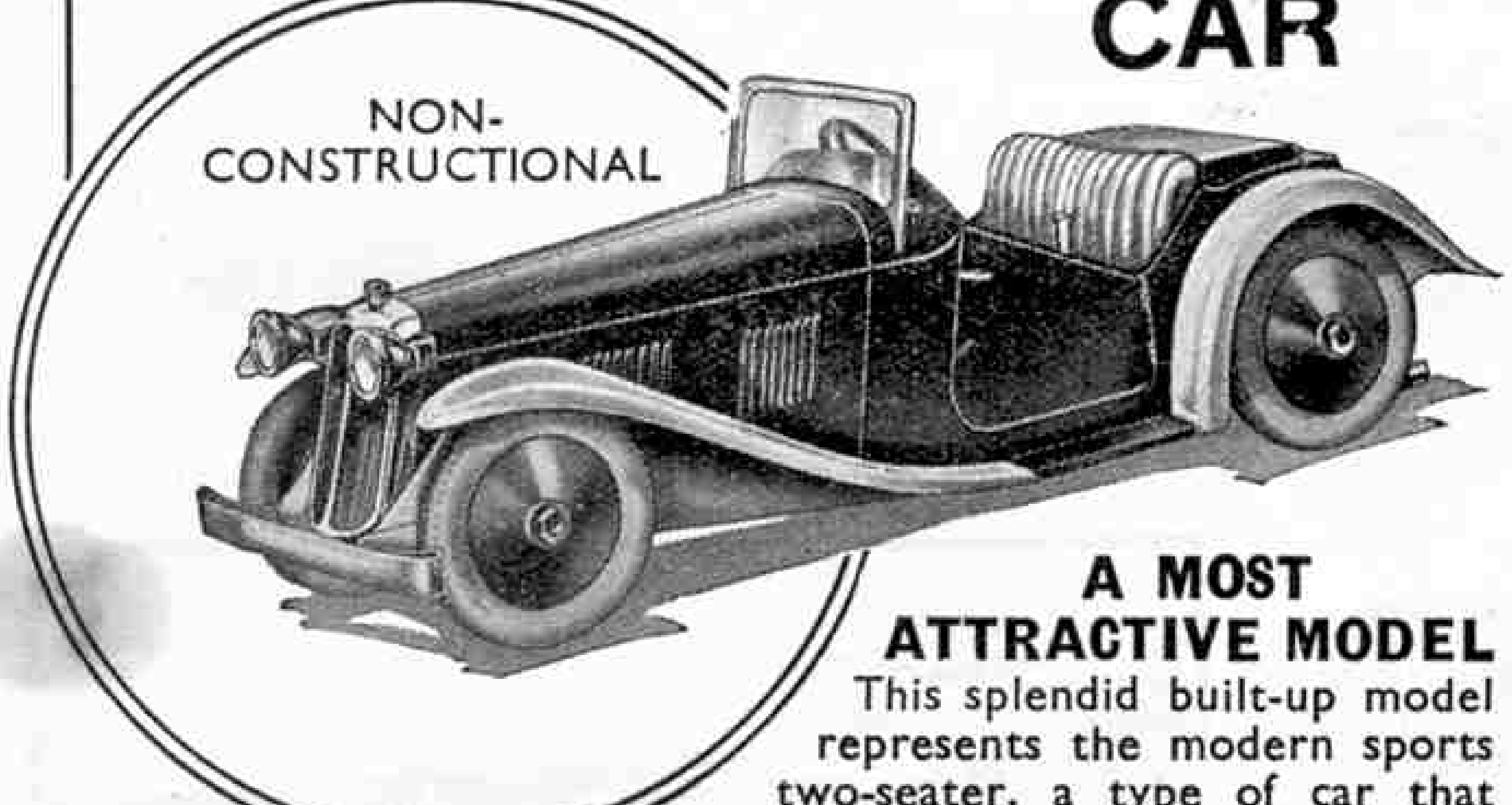
The old type Accessories, fitted for lighting by means of a Distribution Box and Flexible Leads with plugs and sockets are still available at the following prices:

No. E1E Engine Shed	Price 18/6	No. 2E Double Arm Signal	Price 6/6	No. 2E Water Tank	Price 10/–
No. E2E Engine Shed	,, 26/–	No. 2E Junction Signal	,, 9/–	No. 1E Lamp Standard	,, 3/6
No. 2E Station	,, 11/6	No. 2E Signal Gantry	,, 18/–	No. 2E Lamp Standard	,, 4/3
Island Platform E	,, 9/–	No. E1E Level Crossing	,, 7/–	Flexible Leads, 9″, 18″, and 36″.	Prices 1/4, 1/5 and 1/6 respectively.
No. 2E Goods Platform	,, 15/–	No. E2E Level Crossing	,, 11/–		
No. 2E Signal Cabin	,, 5/6	No. 1E Buffer Stops	,, 2/–		
No. 2E Signal	,, 4/3	No. 2E Buffer Stops	,, 7/–	Distribution Box	Price 2/6

Manufactured by MECCANO LTD., BINNS ROAD, LIVERPOOL 13

A REALISTIC TWO-SEATER SPORTS CAR

NON-CONSTRUCTIONAL



A MOST ATTRACTIVE MODEL

This splendid built-up model represents the modern sports two-seater, a type of car that combines speed and excellent road-holding qualities, and has become increasingly popular during recent years. Speed is suggested by the sweeping lines of the bodywork and mudguards, together with the sloping radiator and wind-screen.

The model faithfully resembles its prototype in all important respects. It is complete in itself, no constructional or assembly work being required. It steers from the wheel, and is fitted with a strong clockwork motor that gives a long and steady run.

Overall dimensions: Length, 8¼ in.; Width, 3¾ in.; Depth 2⅞ in.

Price **6/6**

The model is beautifully made and finished, and is available in three different colours—Red, Blue and Cream

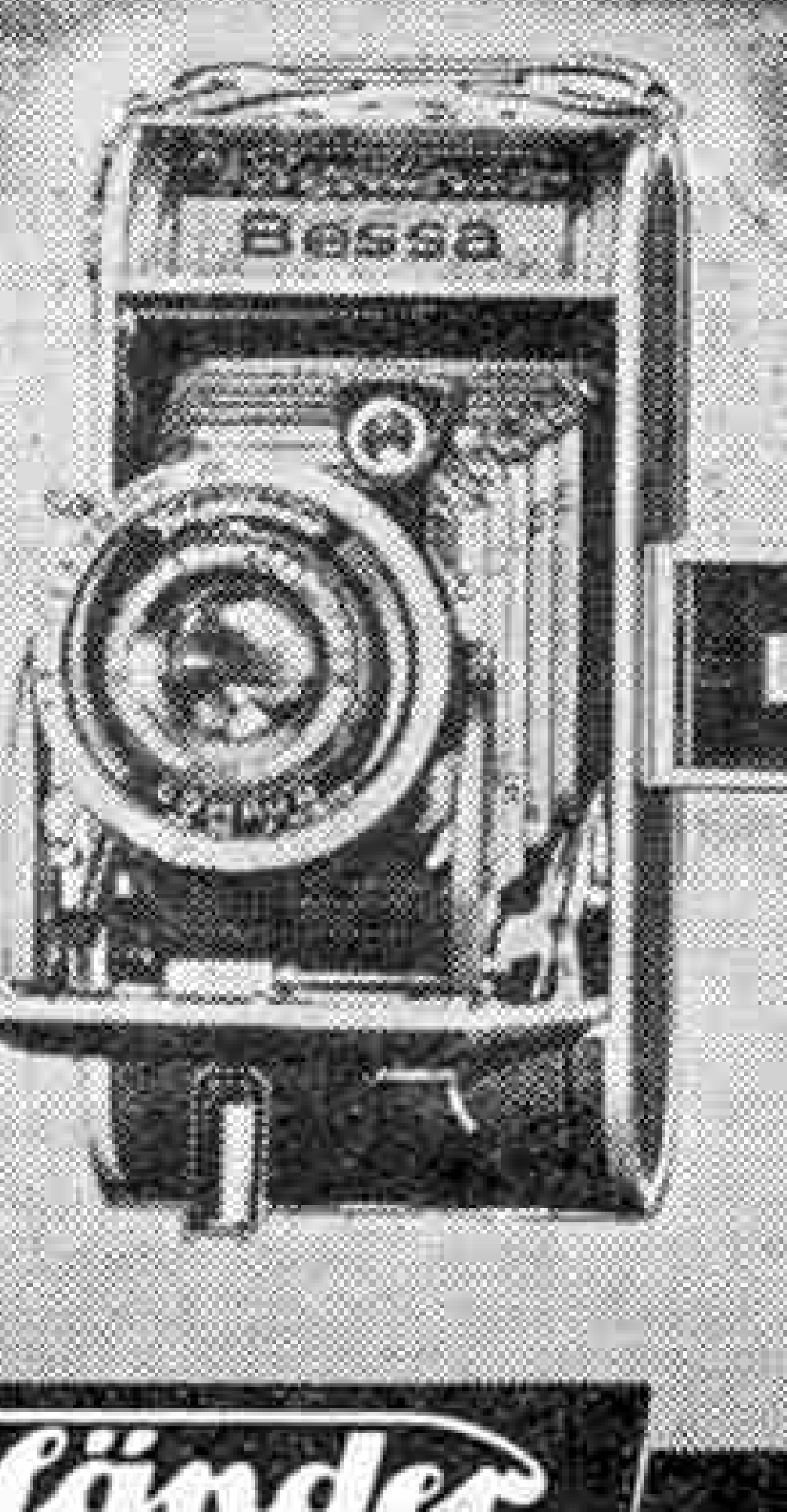
Manufactured by

Meccano Ltd., Binns Rd., Liverpool 13

Taken with a Voigtländer Heliar Lens on Voigtländer Illustra Film

Quick! — click!

the Bessa can capture it for you



With its shutter release (like a rifle trigger) cunningly fitted under the baseboard, the BESSA is easy to use and snap-shots at high speed are free from vibration. Economical, too, this BESSA, as it takes 16 half-size or 8 full-size pictures on a standard 8 ex. 2¼ × 3¼ in. film. Prices from 52/6 to £9/12/6. If you have not already seen the BESSA visit your dealer to-day. Or send for the 1936 Voigtlander Catalogue to:

SCHERING LIMITED (Voigtlander Dept. 9),
188/192, High Holborn, London, W.C.1.

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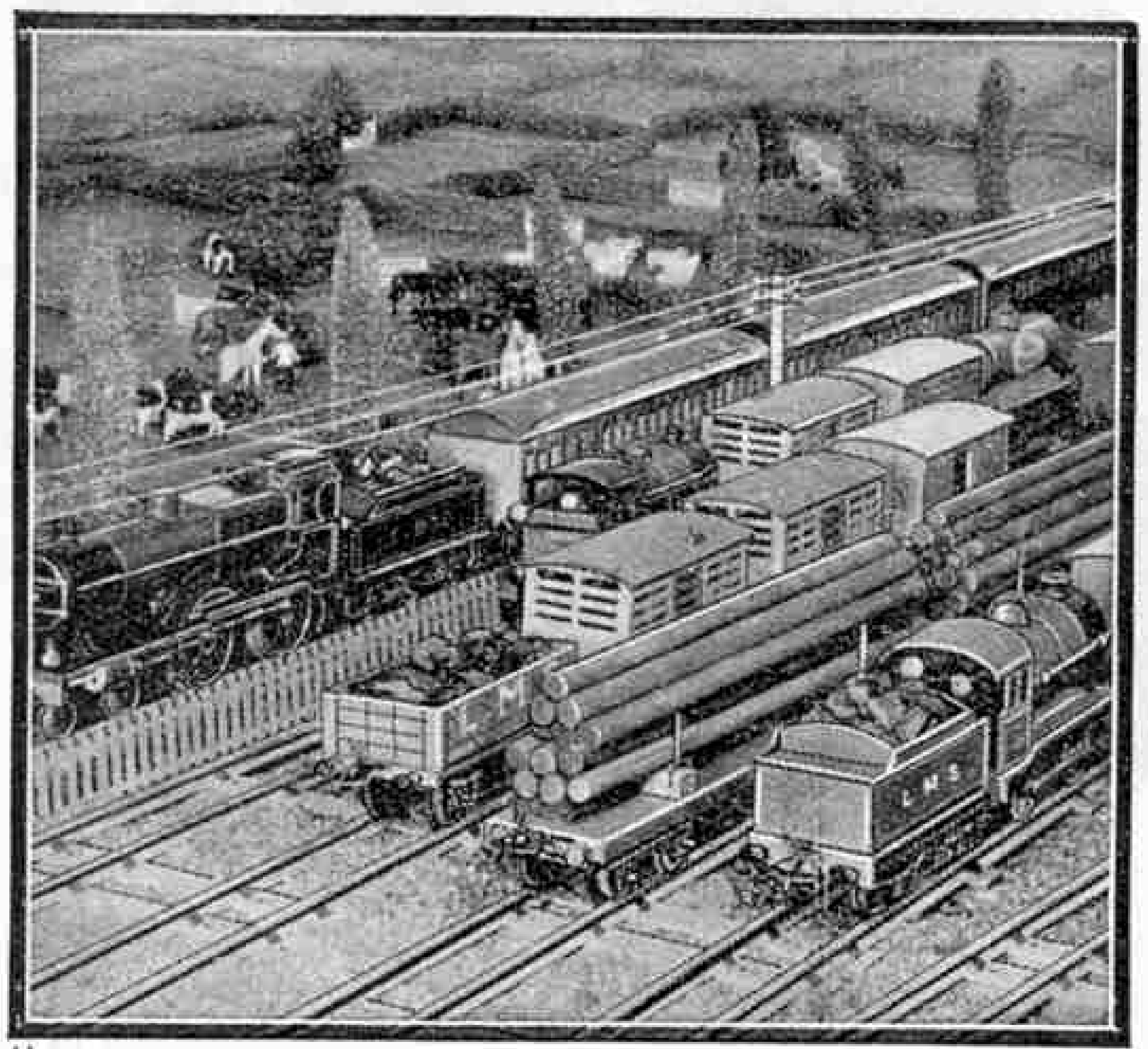
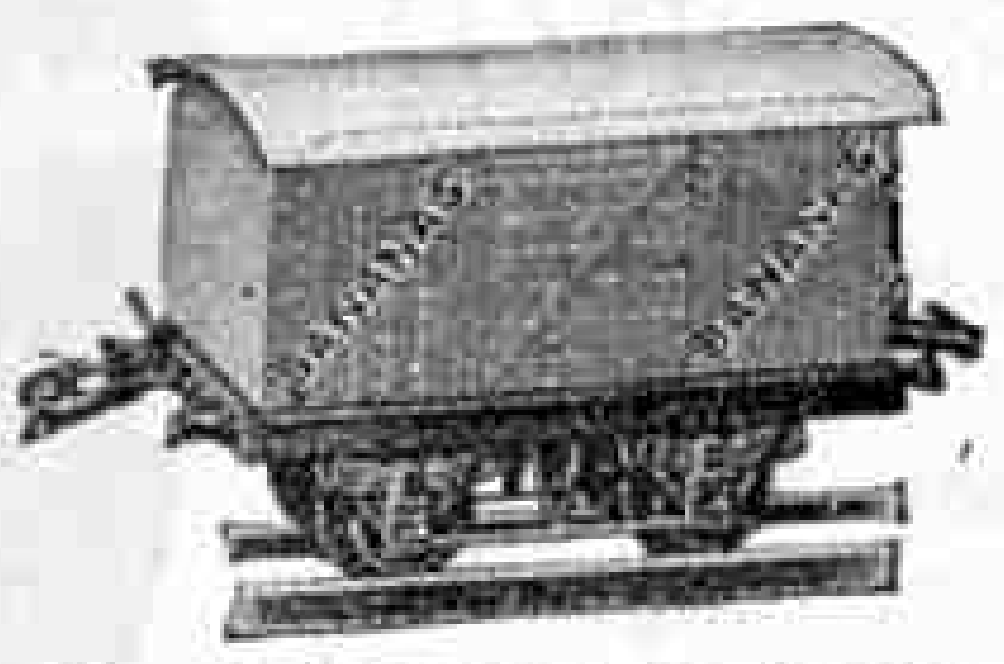
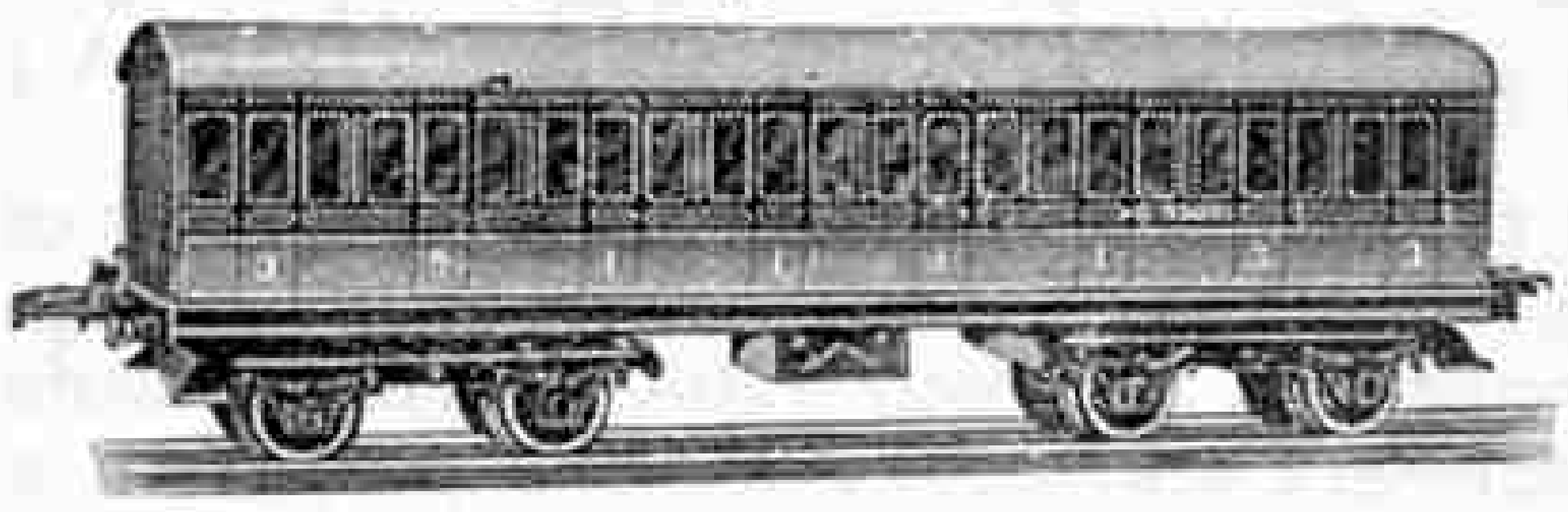


The Hornby Series includes a splendid range of realistic Rolling Stock. Each item is fitted with patented and exclusive automatic couplings, a special feature that places it in a class entirely of its own. There are Pullman Cars, Passenger Coaches, Guards' Vans, Tipping Wagons, Lumber Wagons, and many other types, all beautifully finished.

An attractive selection of Hornby Rolling Stock is illustrated and described on this page. Ask your dealer for a complete price list.



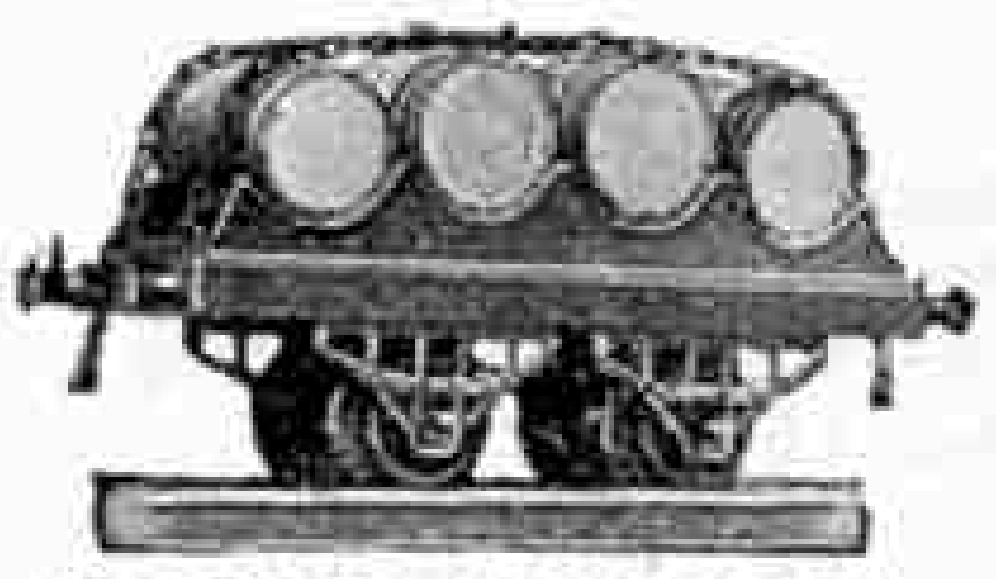
No. 1 BANANA VAN
An attractive model, finished in yellow and red. Price **2/9**



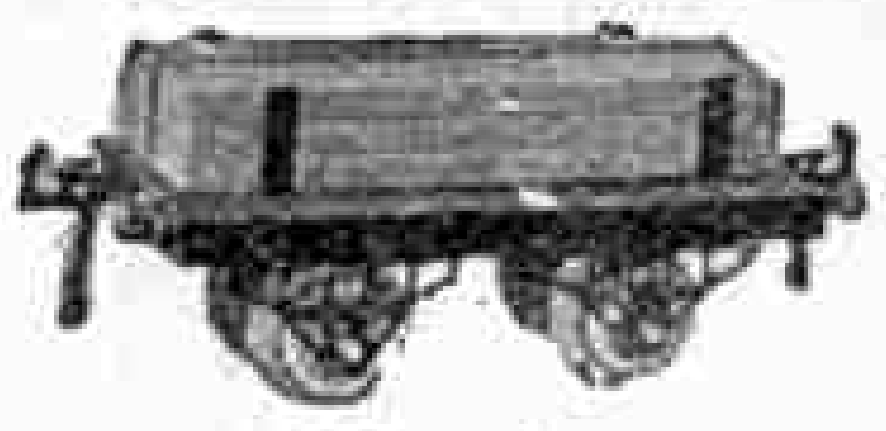
***No. 2 PASSENGER COACH**
Suitable for 2-ft. radius rails only. First-third, or Brake-third. Price **7/6**

MEAT VAN
This is a very realistic model. Available lettered L.M.S. only. Price **1/9**

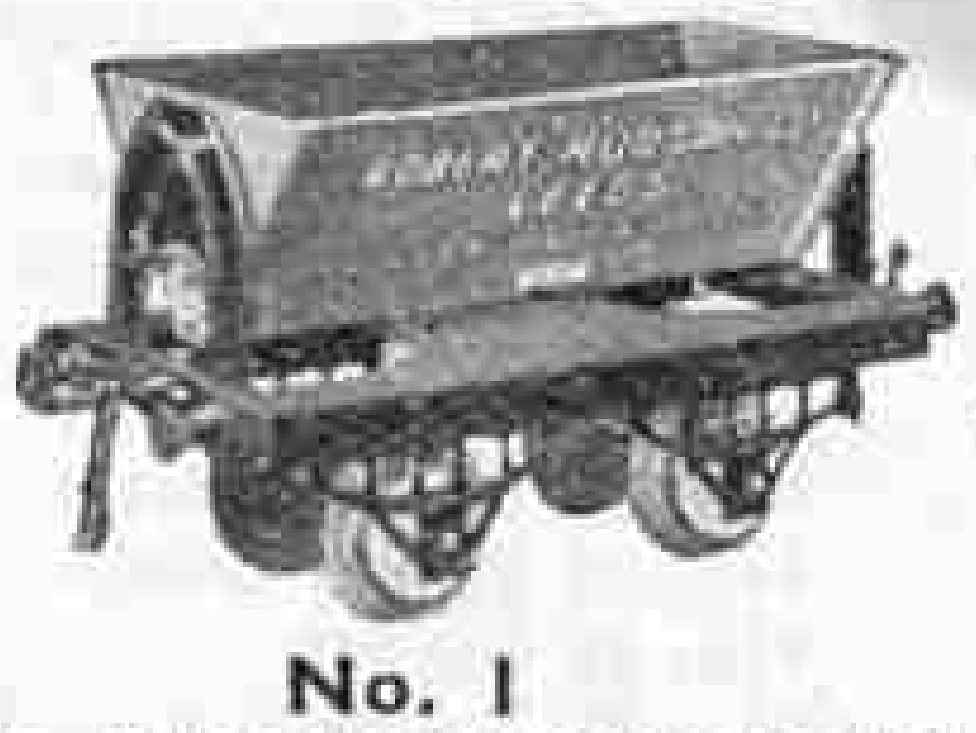
No. 1 MILK TRAFFIC VAN
Fitted with sliding doors Complete with milk cans Price **2/11**



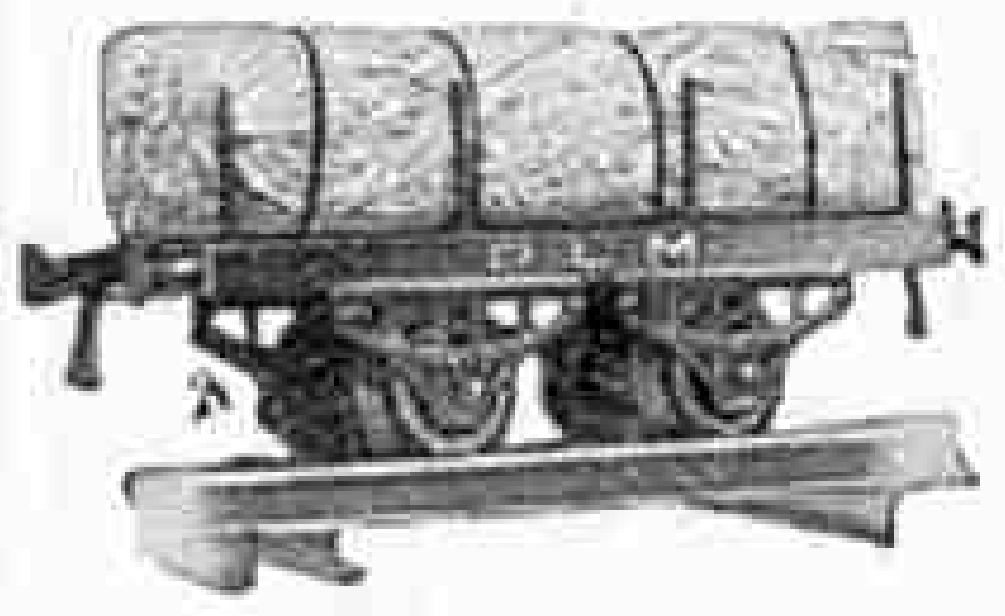
BARREL WAGON
This is another interesting model of a type of wagon used in France and other European countries. Price **2/6**



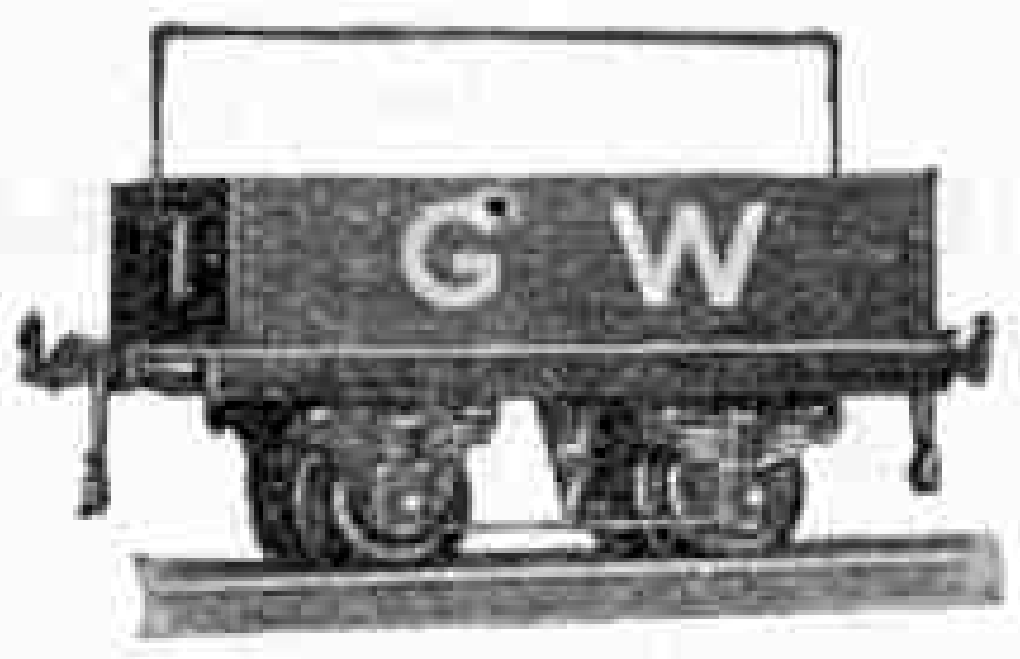
No. 1 TIMBER WAGON
Beautifully enamelled in yellow and red. Price **1/6**



No. 1 SIDE TIPPING WAGON
Excellent design and finish. Lettered "Robert Hudson Ltd." Price **2/–**

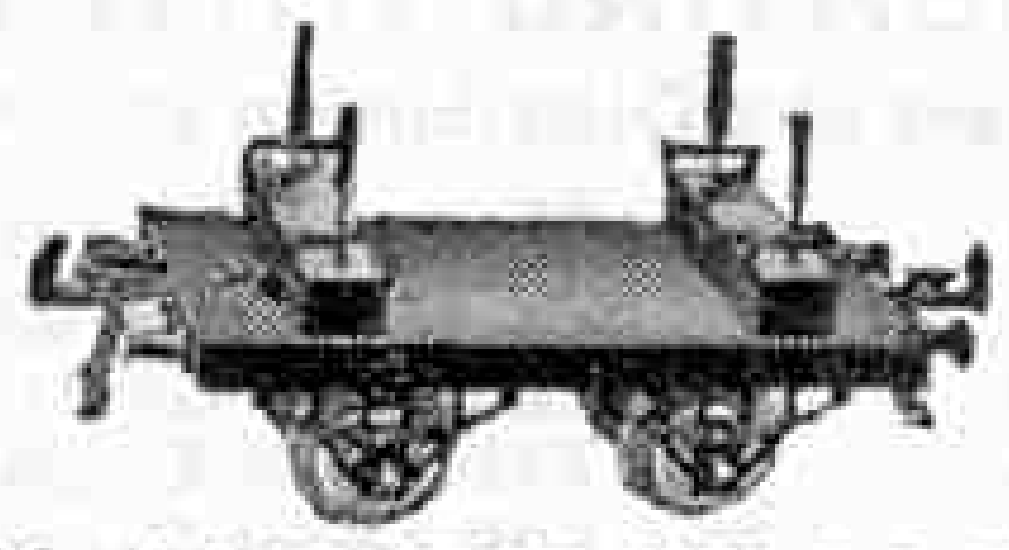


FIBRE WAGON
This is an interesting model of a type of wagon used in France and other European countries. Price **1/3**

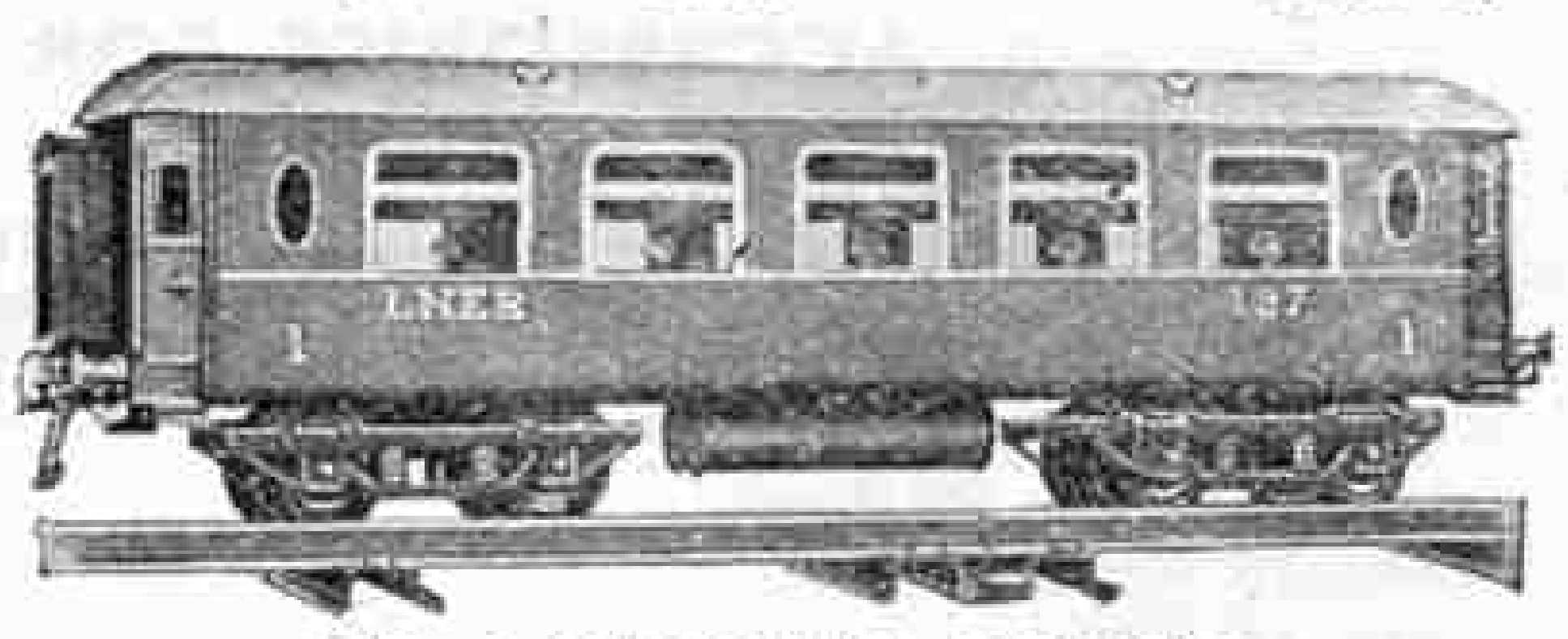


***OPEN WAGON "B"**
Similar to Hornby Wagon No. 1 but fitted with centre tarpaulin supporting rail. Price **2/–**

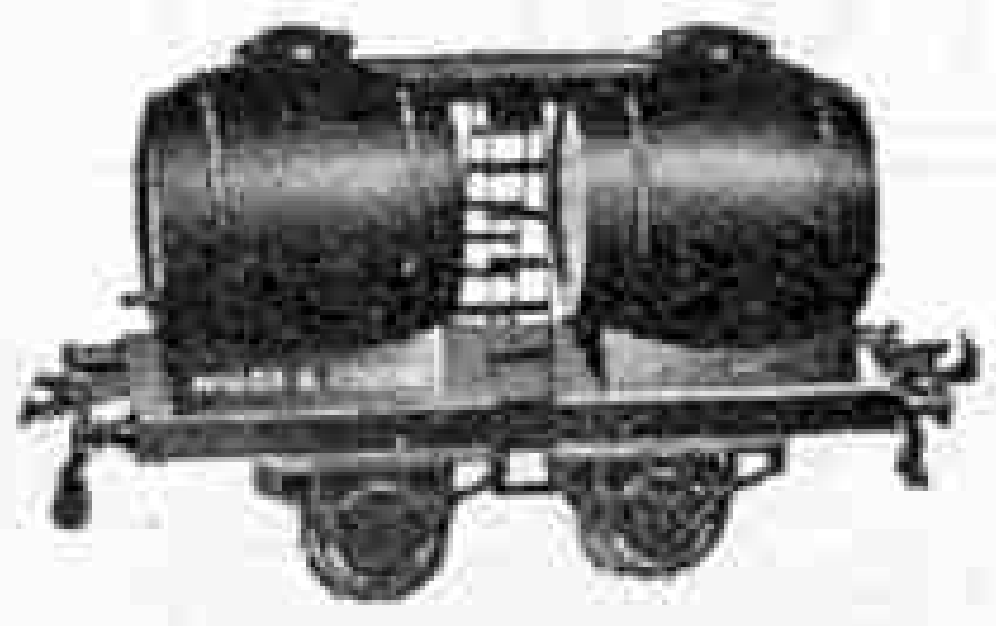
***GUNPOWDER VAN**
Finished in red. With opening doors. Price **2/9**



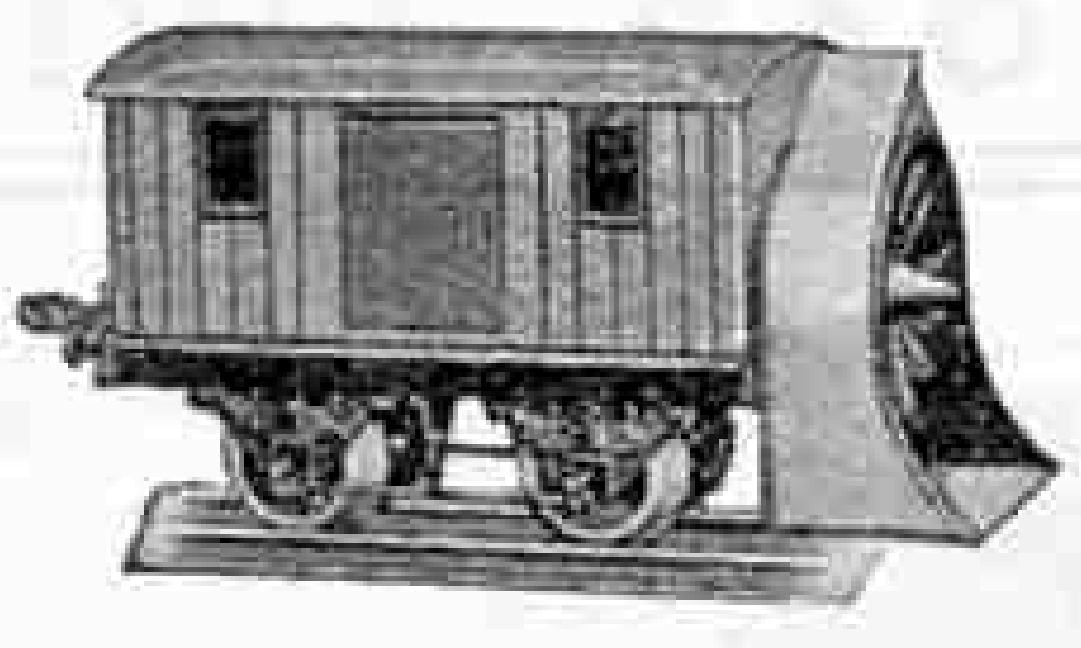
No. 1 LUMBER WAGON
Fitted with bolsters and stanchions for log transport. Price **1/6**



No. 2 SALOON COACH
Realistic in design and beautifully finished. Two types are available: L.N.E.R. (as illustrated) enamelled brown, and L.M.S. enamelled maroon. Suitable for 2-ft. radius rails only. Price **9/6**

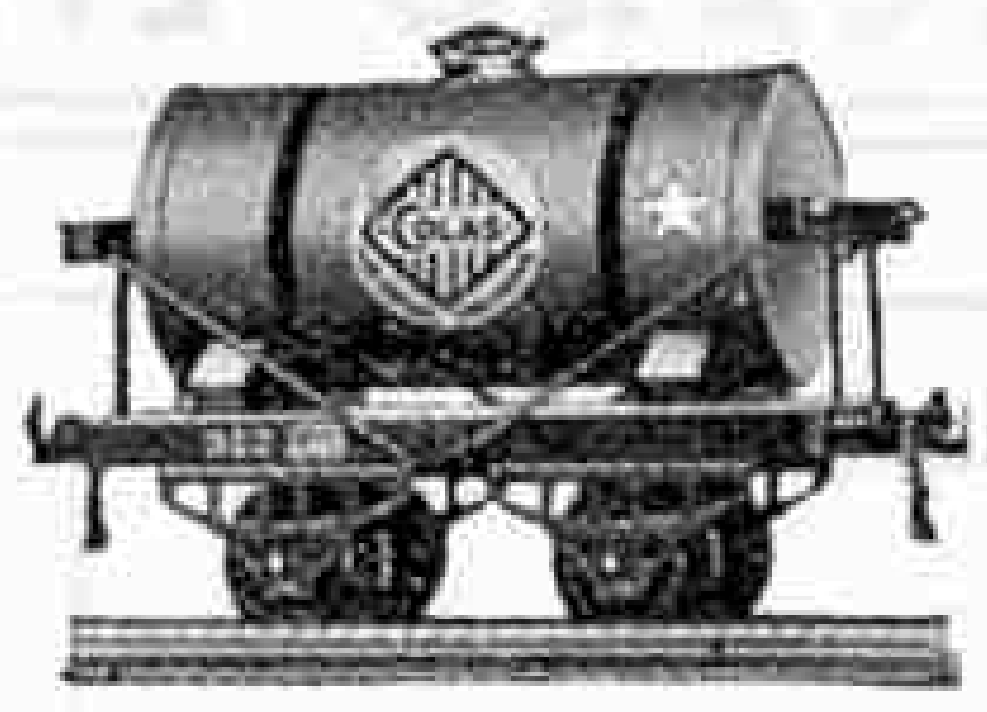


WINE WAGON DOUBLE BARREL
An attractive model artistically enamelled in red and green. Price **4/6**

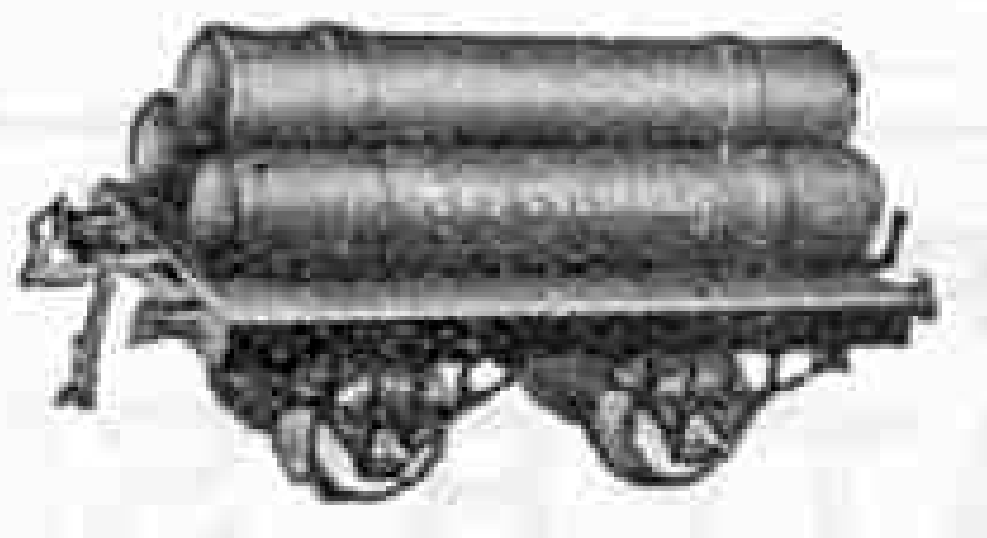


SNOW PLOUGH
With revolving plough. Price **3/9**

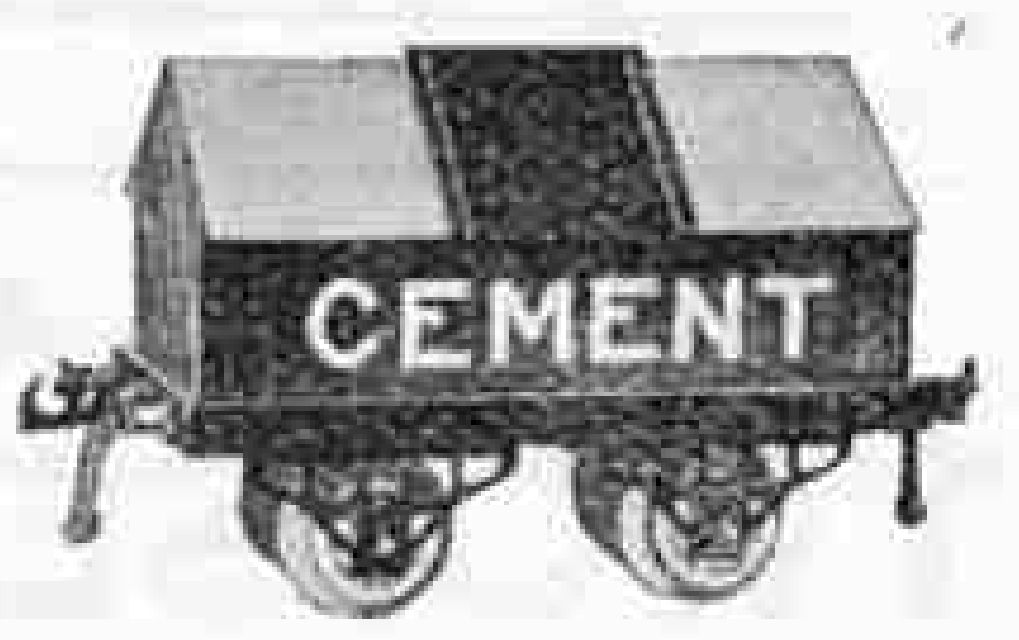
COVERED WAGON (French Type)
This wagon is fitted with frame and sheet. Lettered "Nord." Price **2/6**



BITUMEN TANK WAGON "COLAS"
Finished in blue. Price **3/6**



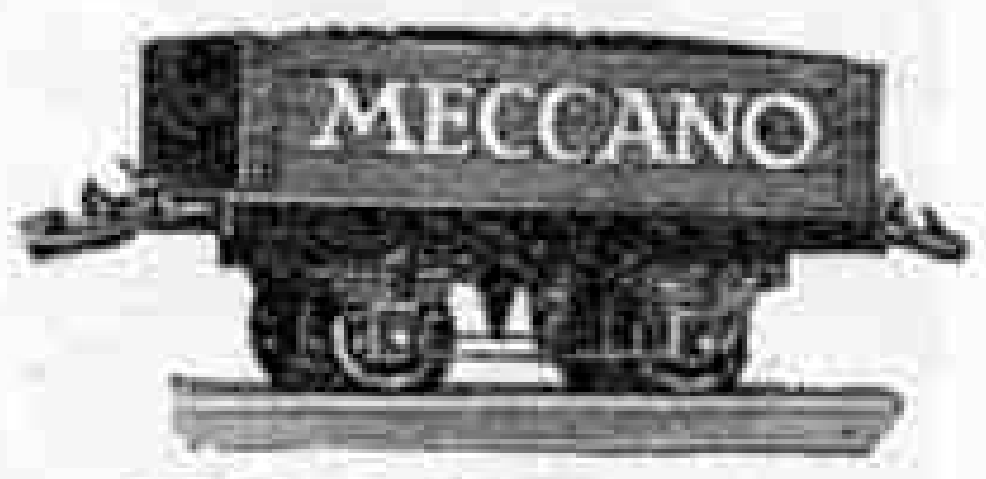
GAS CYLINDER WAGON
Finished in red, lettered gold. Price **1/11**



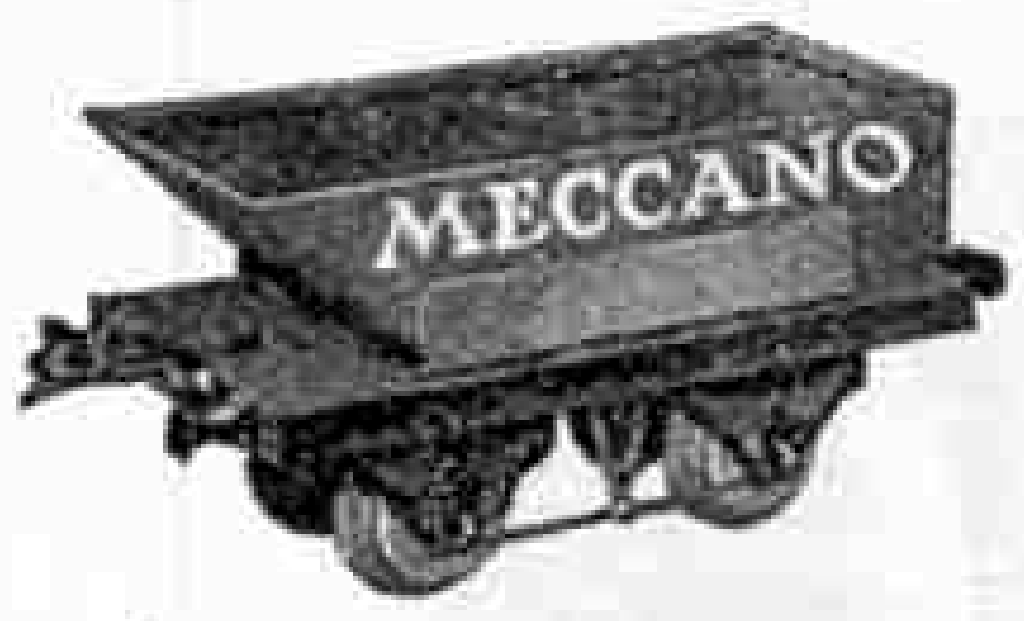
CEMENT WAGON
The door at the top opens. Finished in bright red. Price **2/6**

No. 1 PETROL TANK WAGON "B.P."
Finished in yellow. Price **2/–**

OIL TANK WAGON "MOBILOIL"
Finished in battleship grey. Price **2/–**

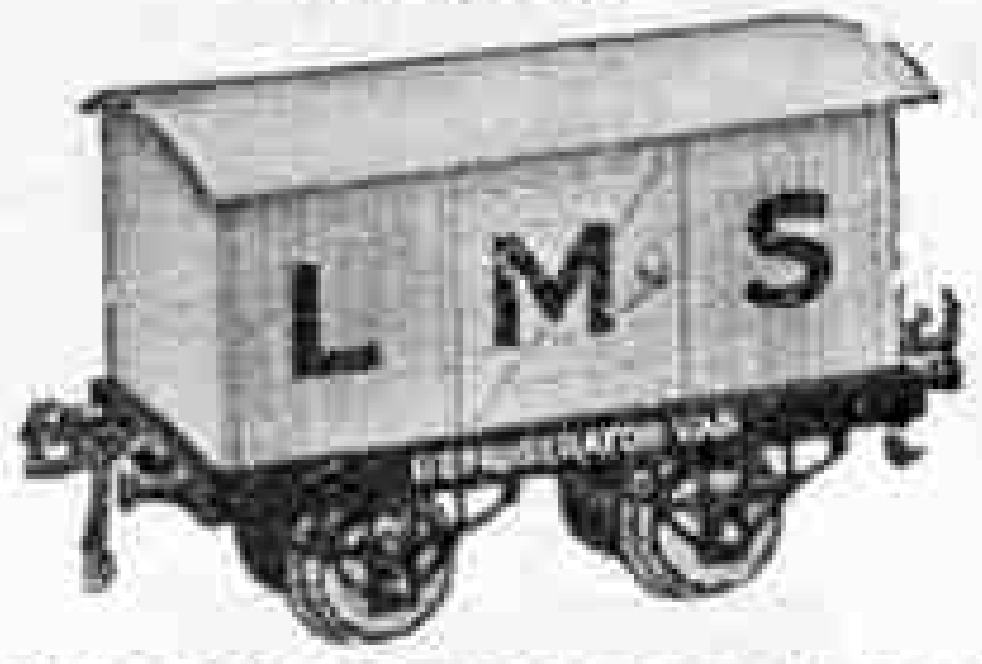


COAL WAGON
This is similar to Hornby Wagon No. 1. It is fitted with embossed representation of coal. Price **2/3**

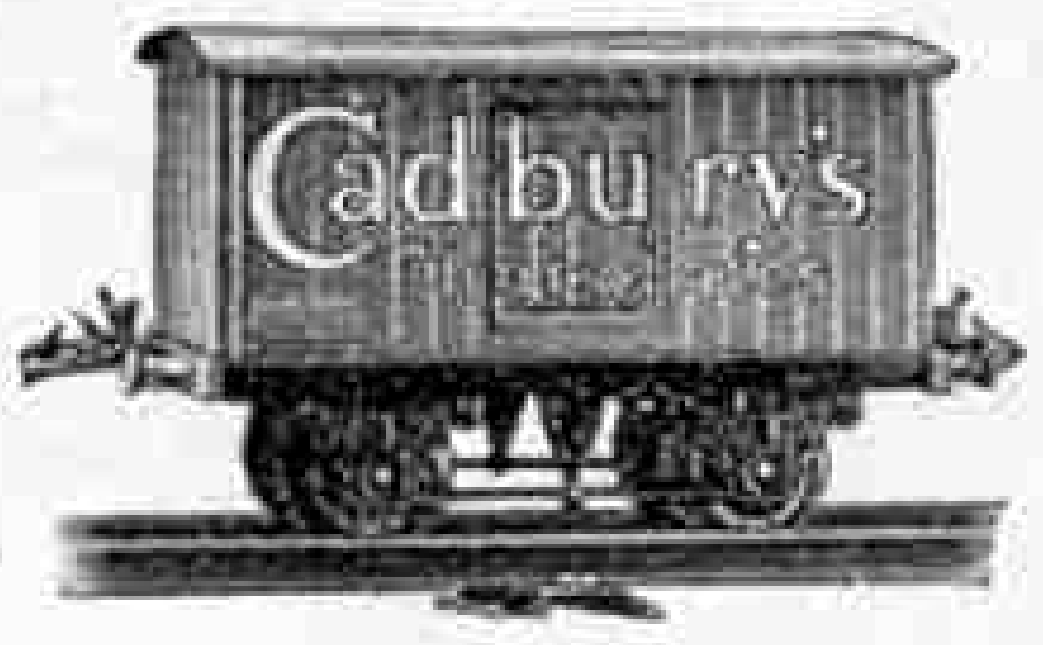


No. 1 ROTARY TIPPING WAGON
Finished in orange. Price **2/6**

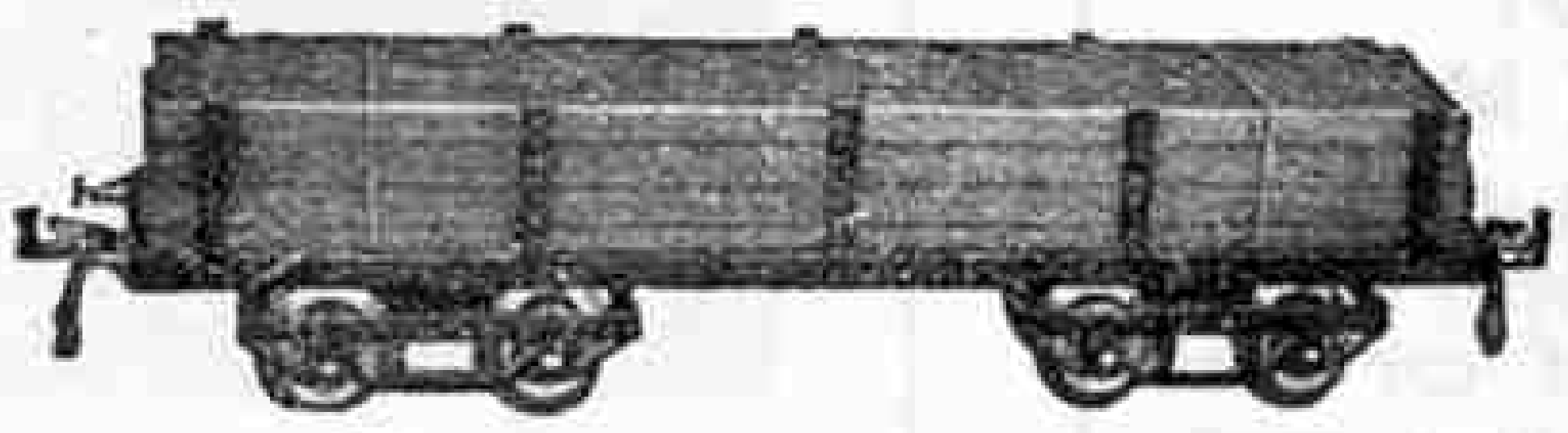
TROLLEY WAGON
Finished in brown and blue. Suitable for 2-ft. radius rails only. Price **3/11**



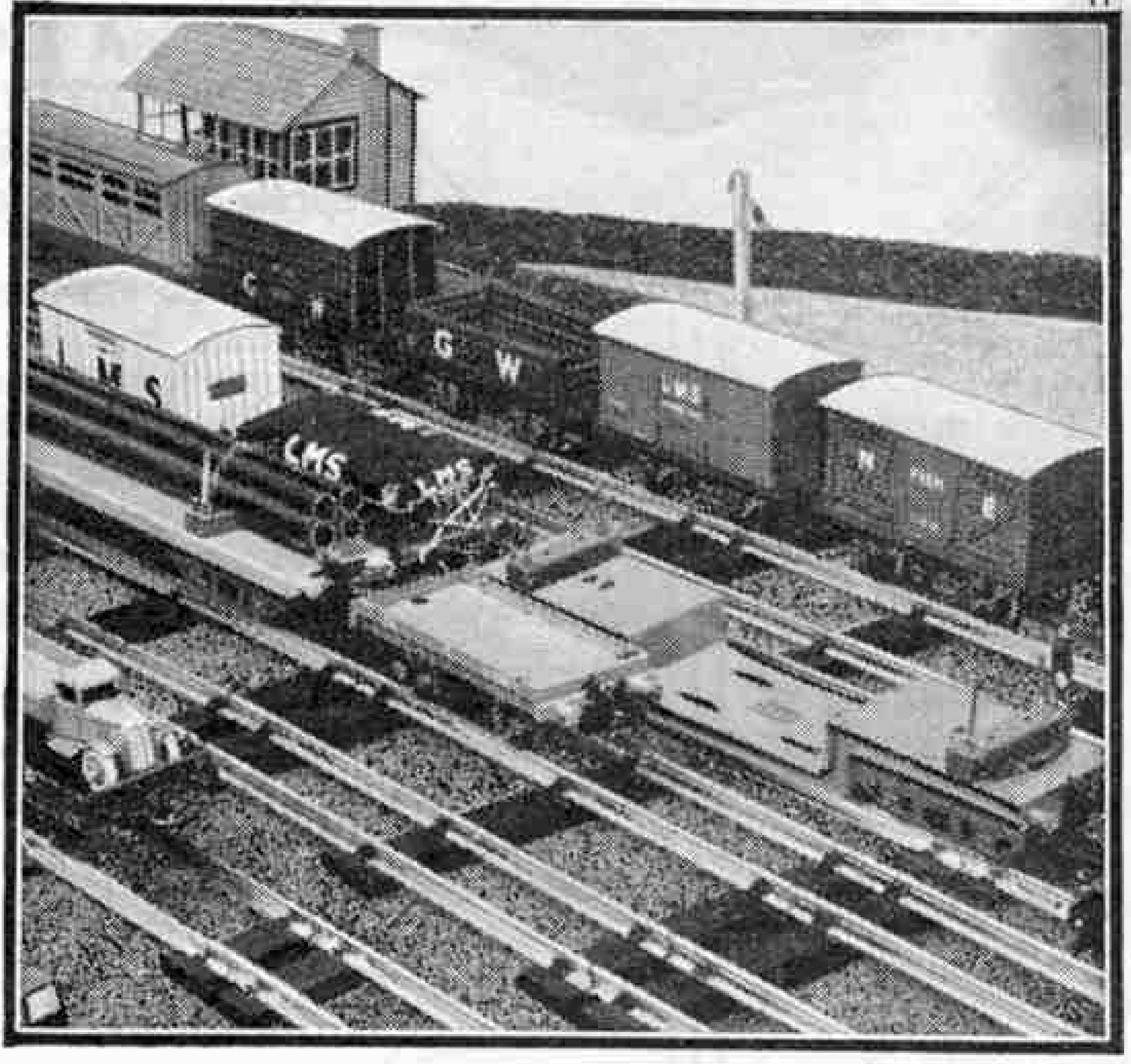
***REFRIGERATOR VAN**
Beautifully enamelled. Fitted with opening doors. Price **2/9**

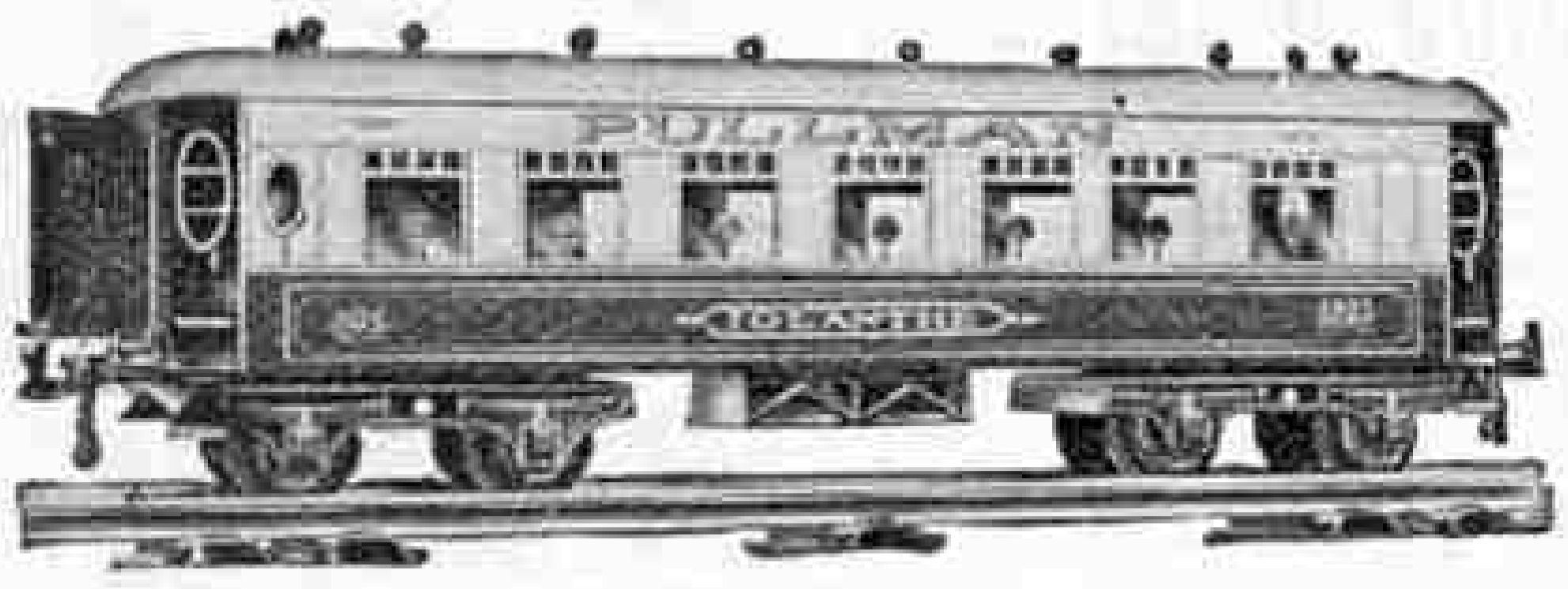


CHOCOLATE VAN "CADBURY'S"
This van is beautifully enamelled in blue with white roof. Price **2/9**

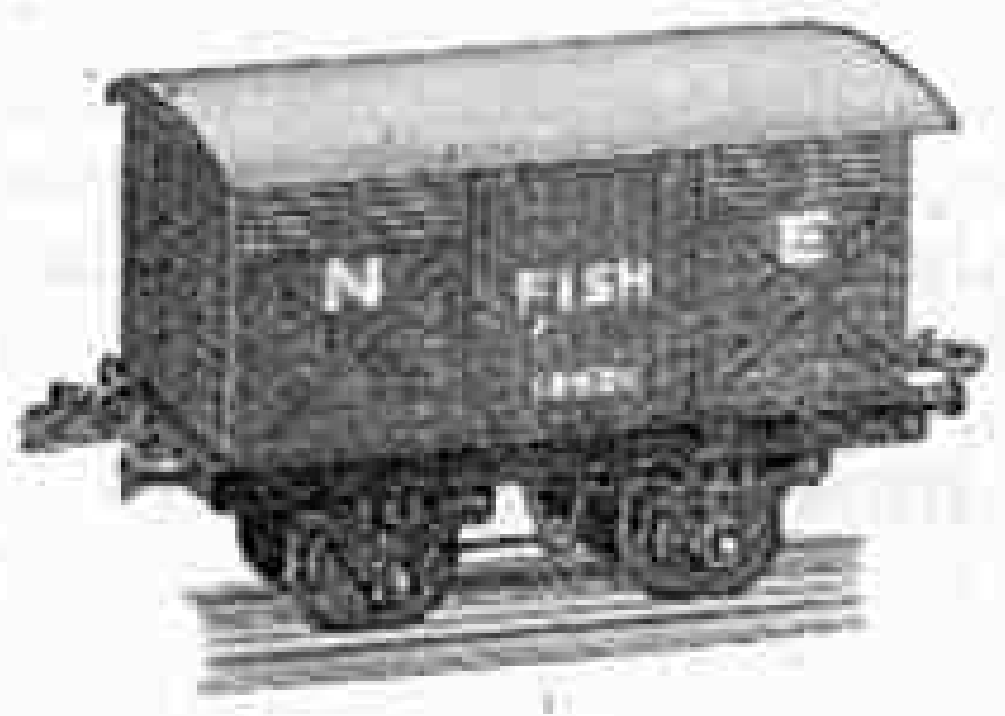


No. 2 TIMBER WAGON
Beautifully enamelled in green and red. Suitable for 2-ft. radius rails only. Price **2/6**

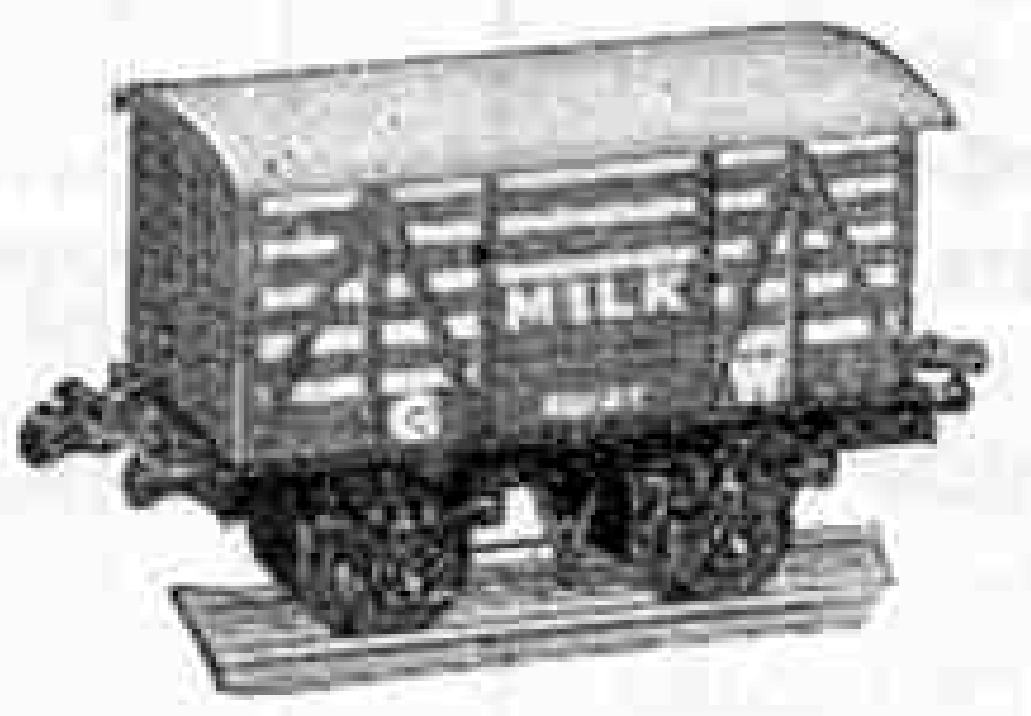




No. 2 SPECIAL PULLMAN COACH
As supplied with No. 2 Special and No. 3 Pullman Train Sets. This splendid coach is perfect in detail and finish. Suitable for 2-ft. radius rails only. Price **13/–**



FISH VAN
This is a distinctive model. Available lettered N.E. only. Price **1/9**

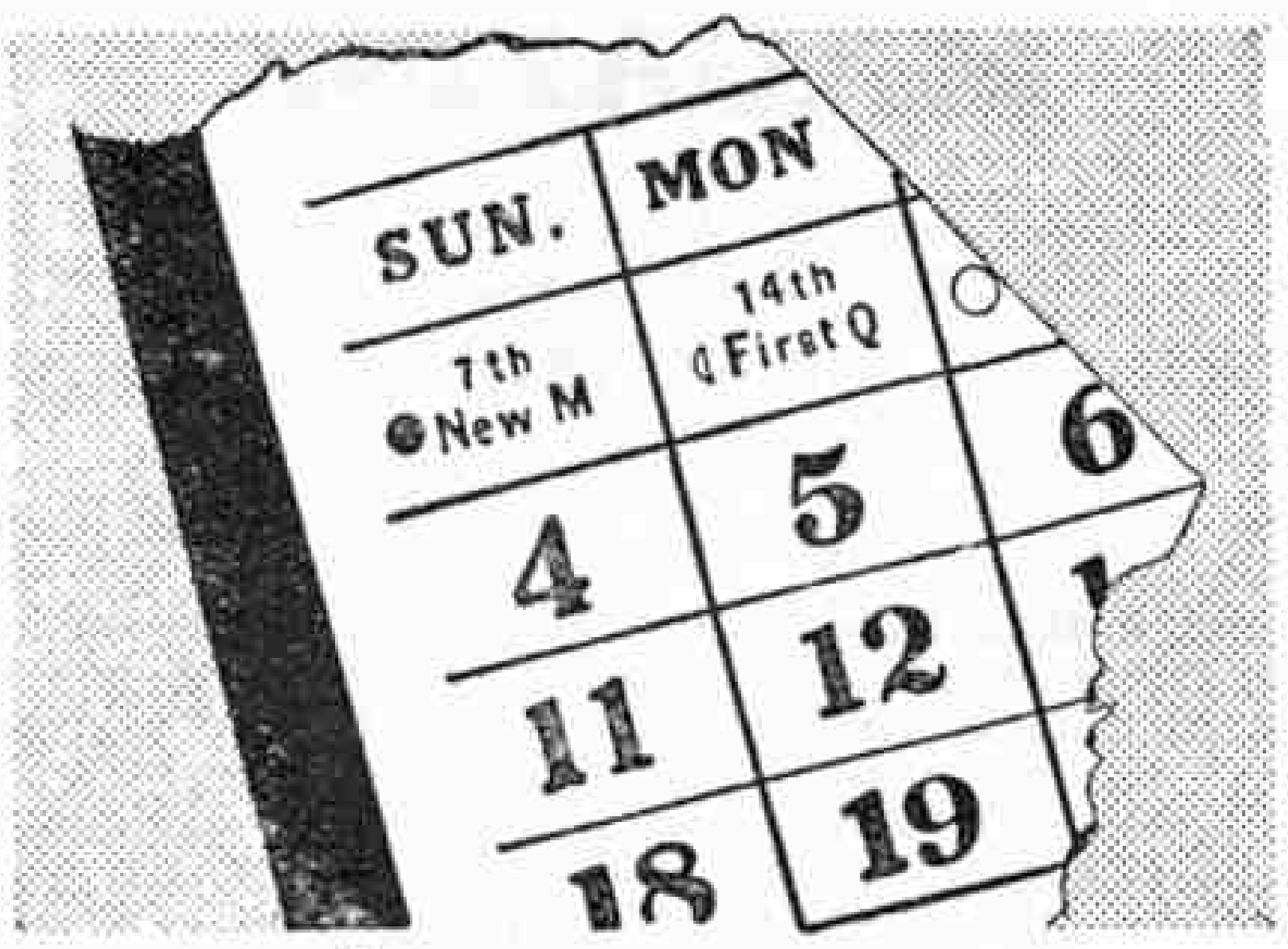


No. 0 MILK TRAFFIC VAN
An attractive model. Available lettered G.W. only. Price **1/9**

**In L.M.S., L.N.E.R., G.W. or S.R. lettering.*

Manufactured by MECCANO LTD., BINNS ROAD, LIVERPOOL 13

EVERY DAY



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Short-Story Writing
Window Dressing
Works Management

TECHNICAL AND INDUSTRIAL

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Air Conditioning
Architecture
Boilermaking
Building
Chemical Engineering
Civil Engineering
Dairy Farming
Draughtsmanship
Electrical Engineering
Engineering Shop Practice
Gas-Power Engineering
Horticulture
Heating and Ventilating
Marine Engineering
Mechanical Engineering
Mining
Motor Engineering
Municipal Engineering
Pattern-making
Plumbing
Poultry Farming
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Sheet-Metal Work
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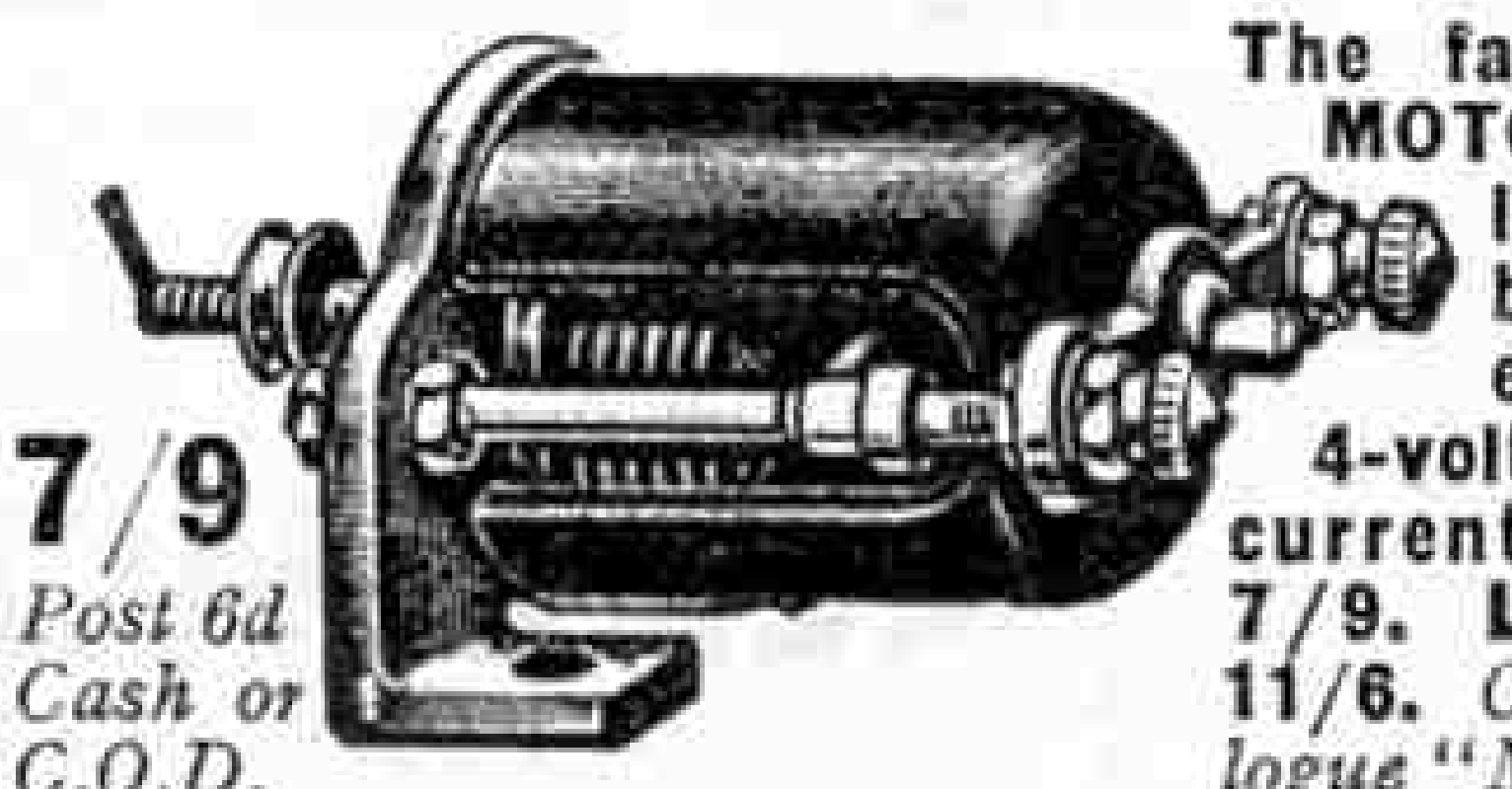

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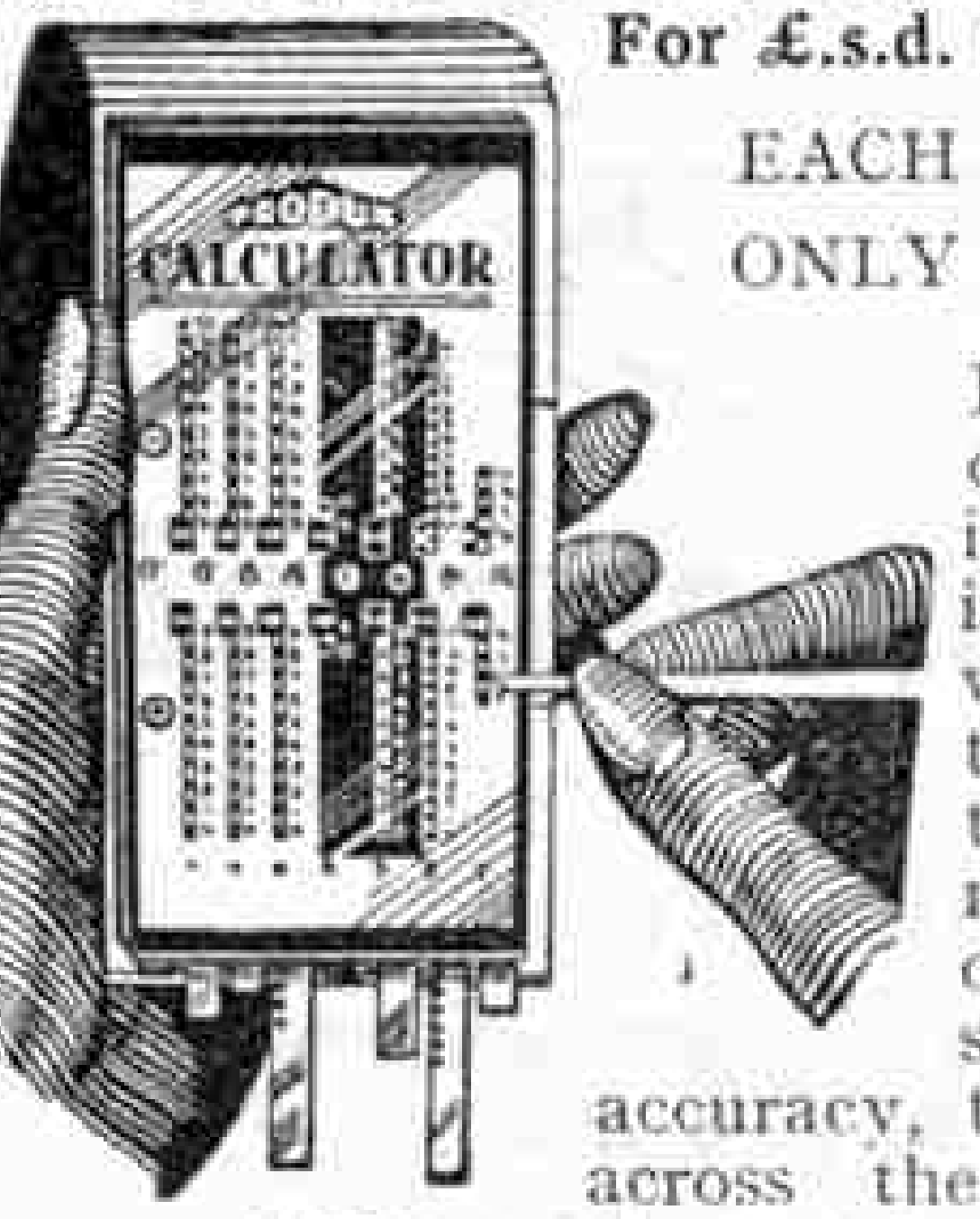

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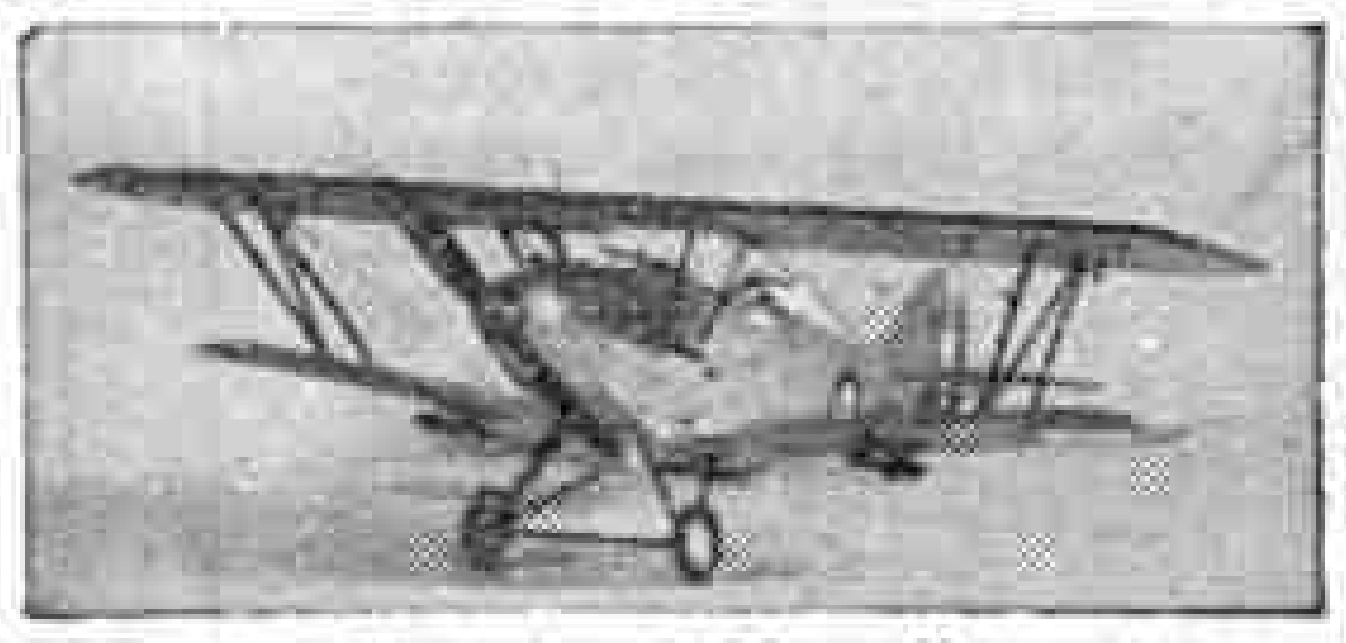

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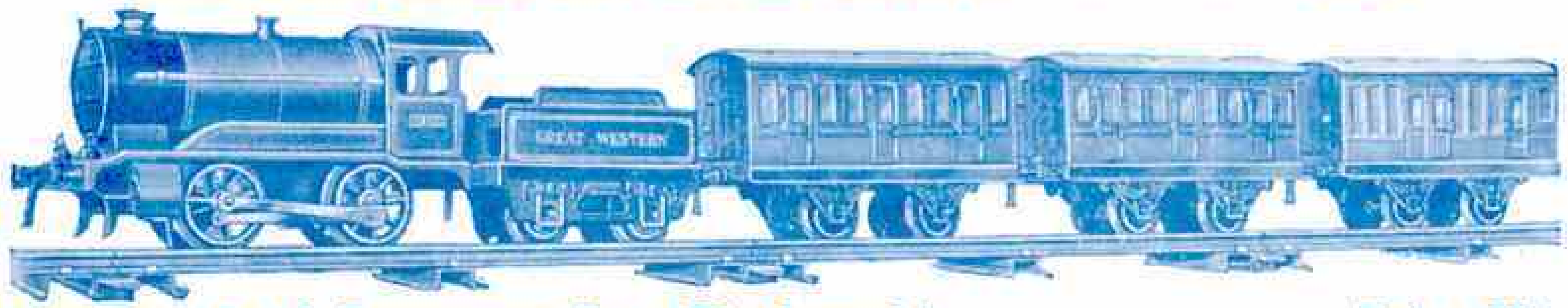

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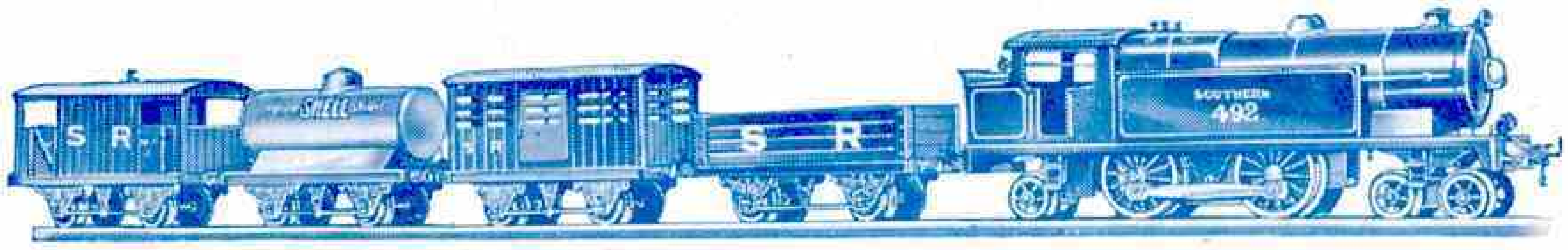

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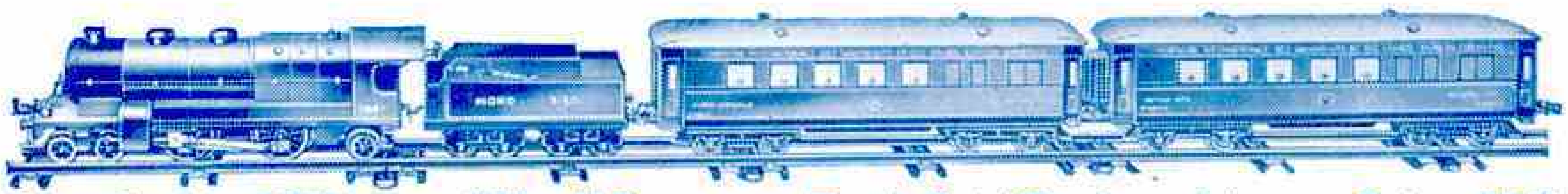

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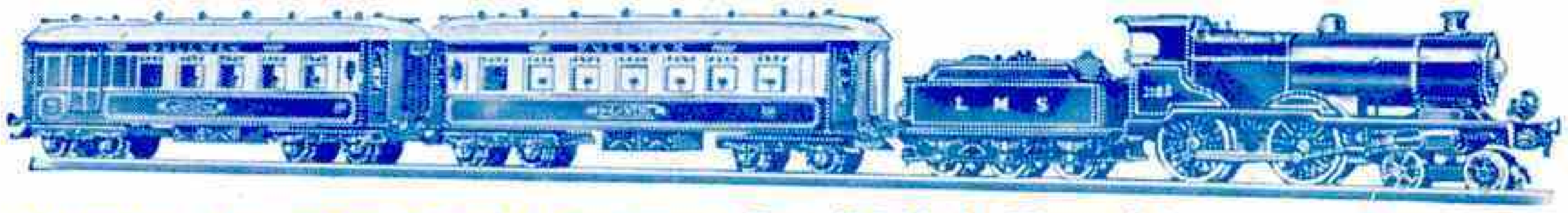

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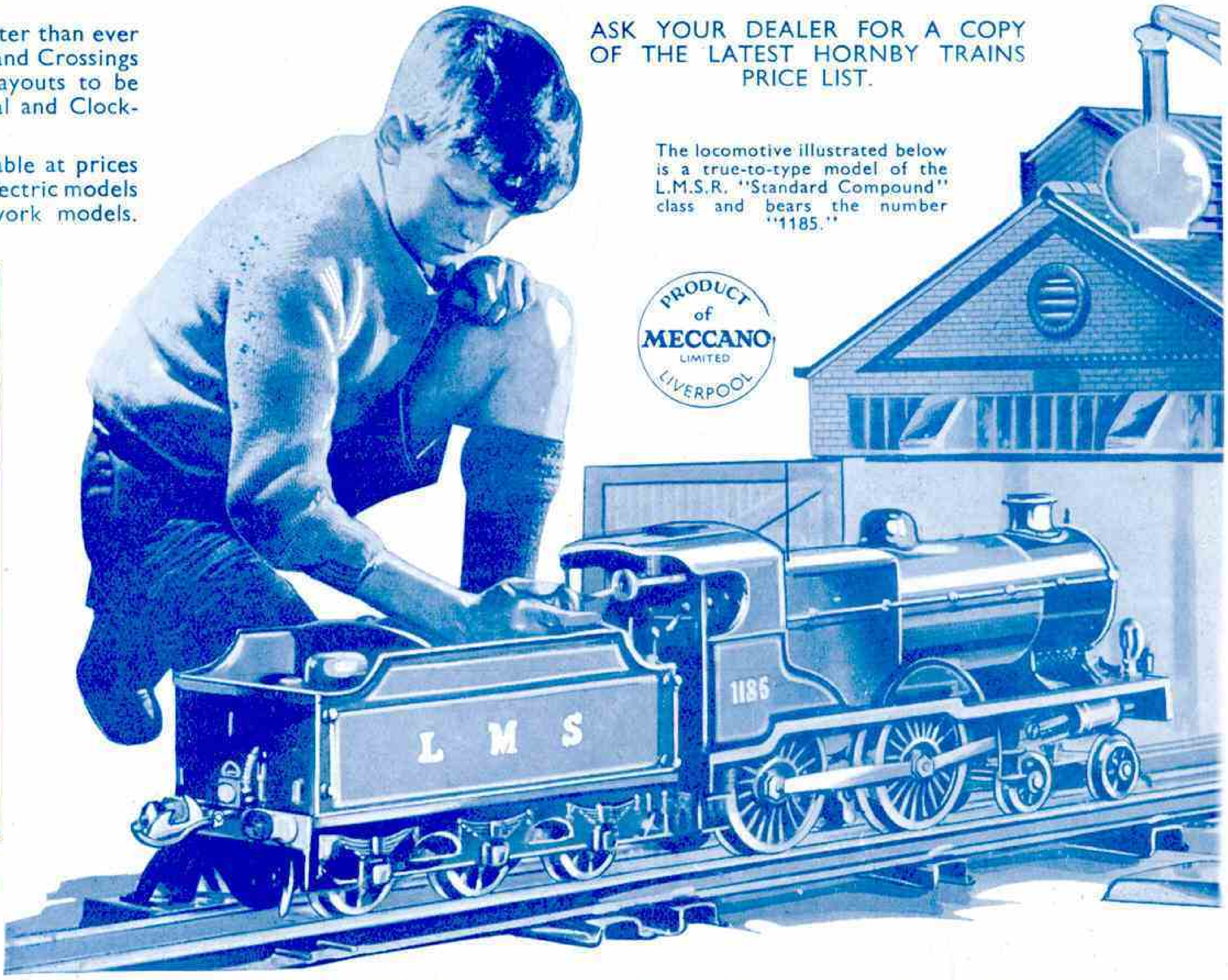

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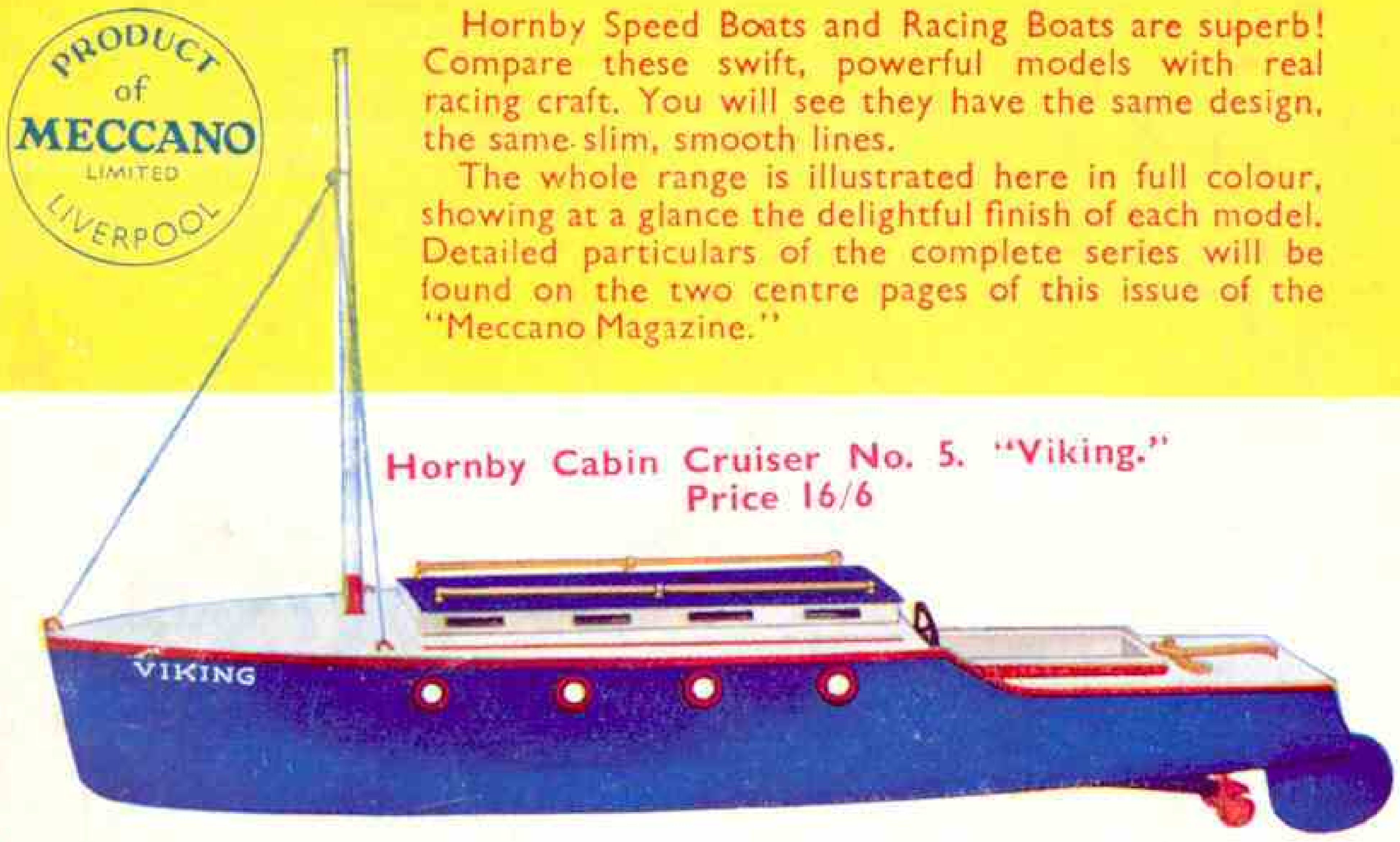

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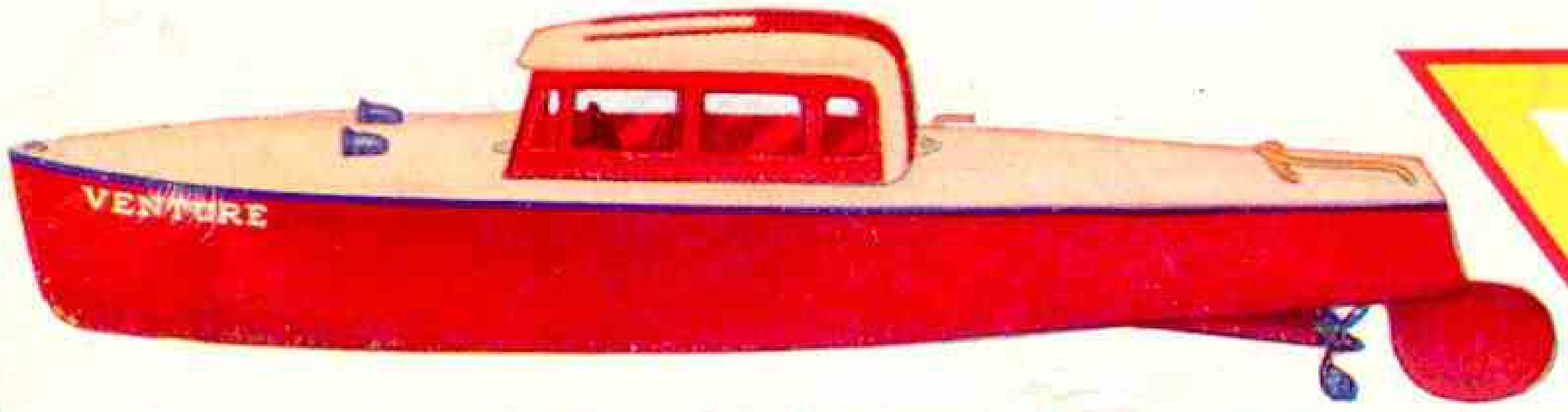

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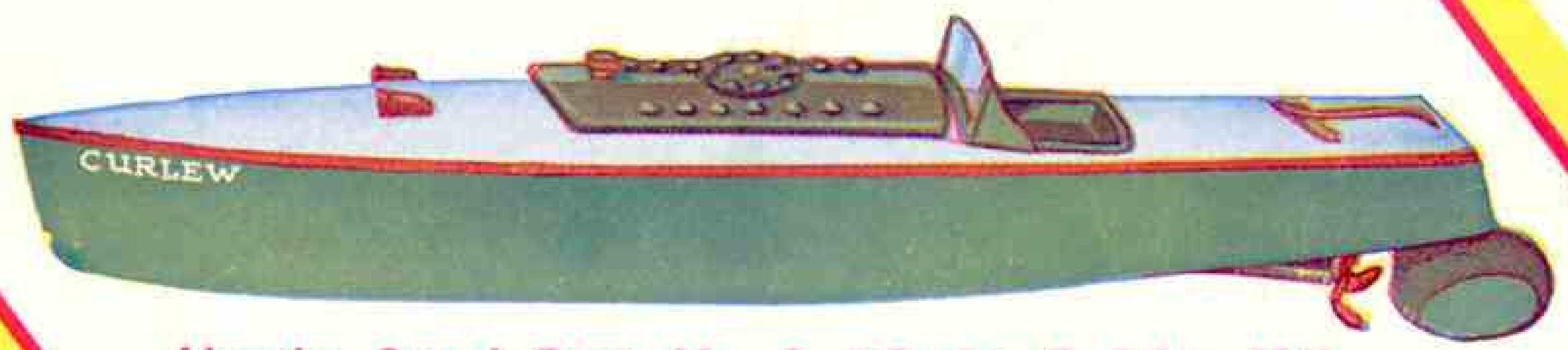

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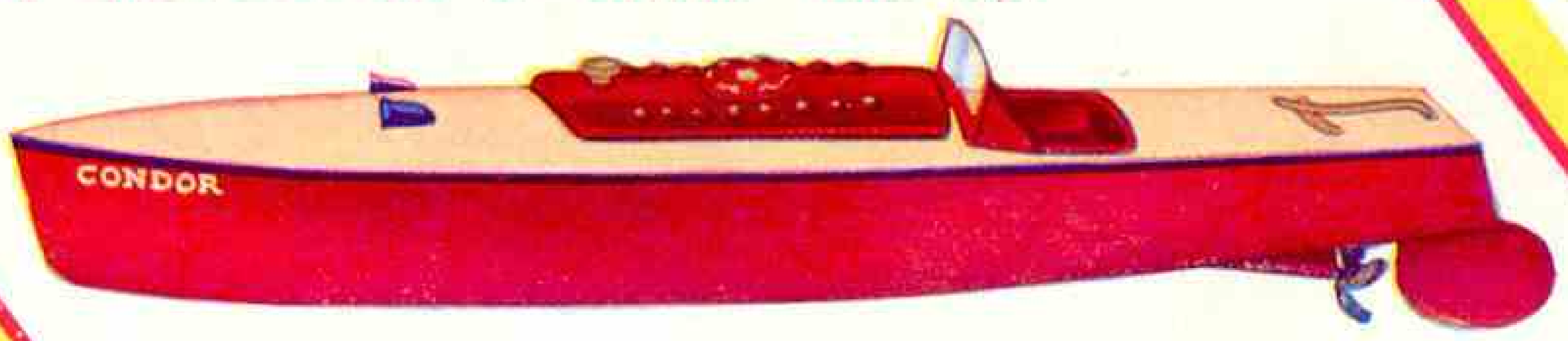

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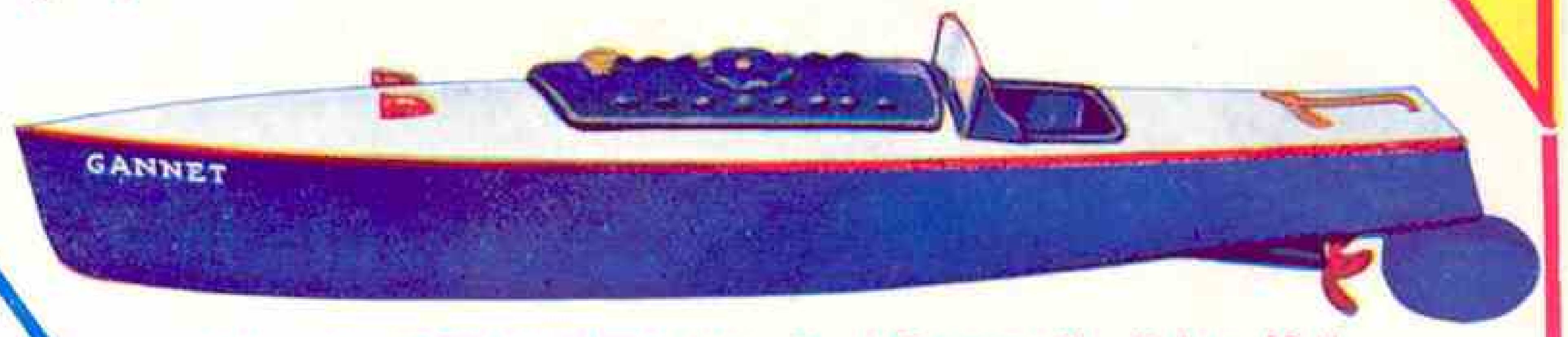

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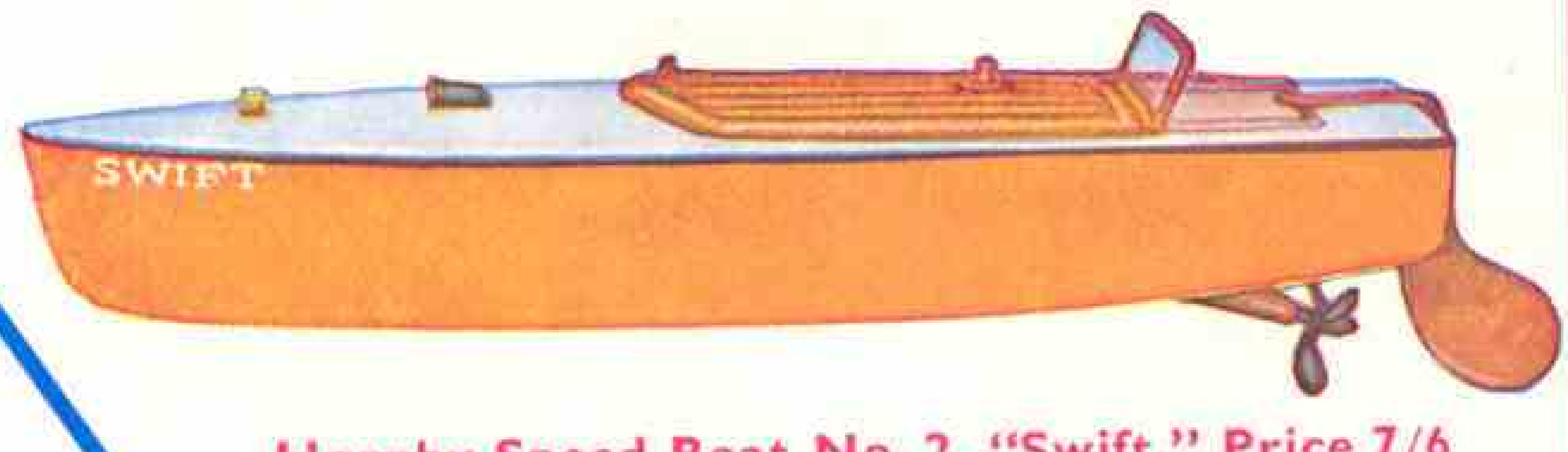

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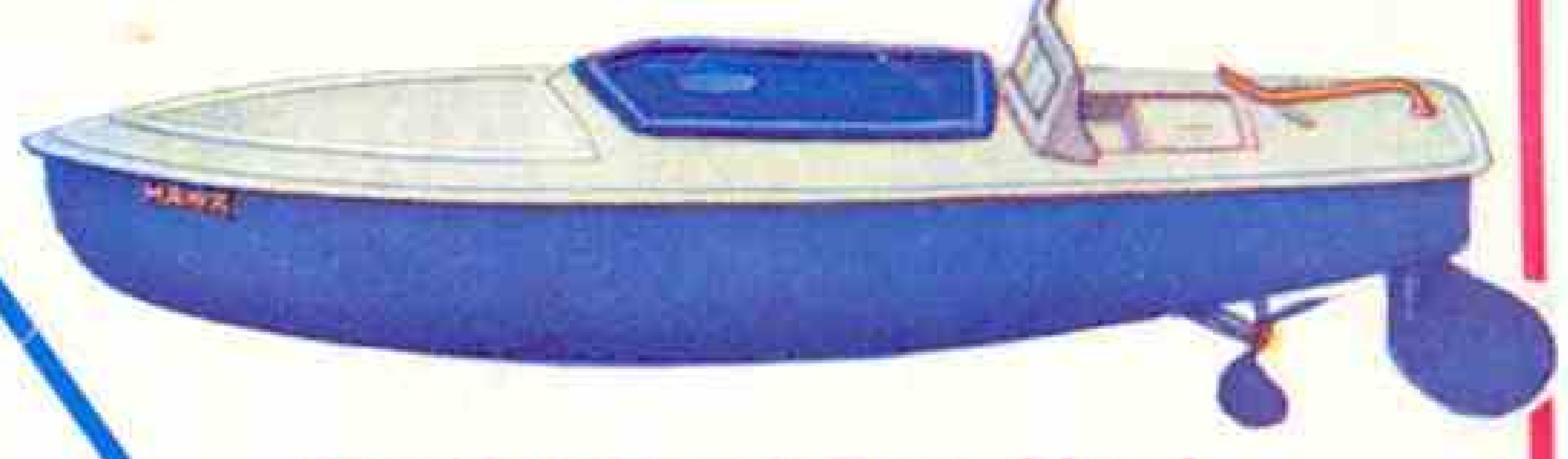

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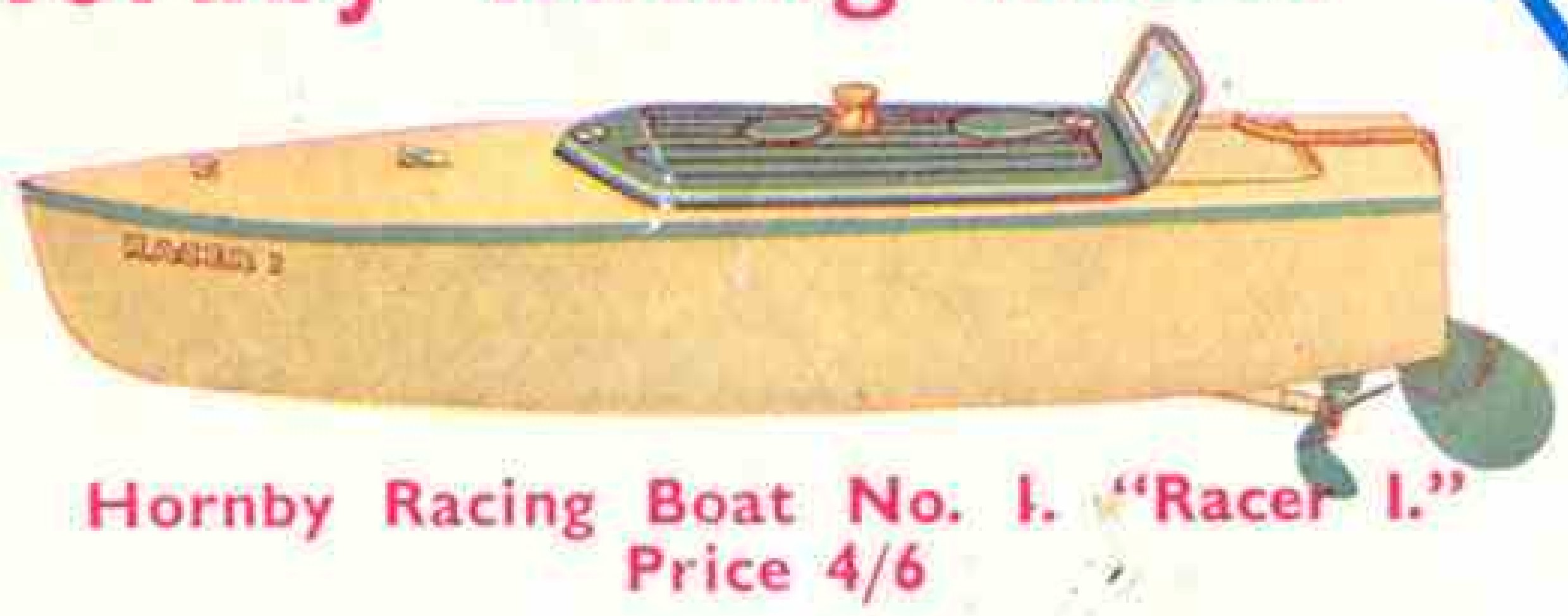

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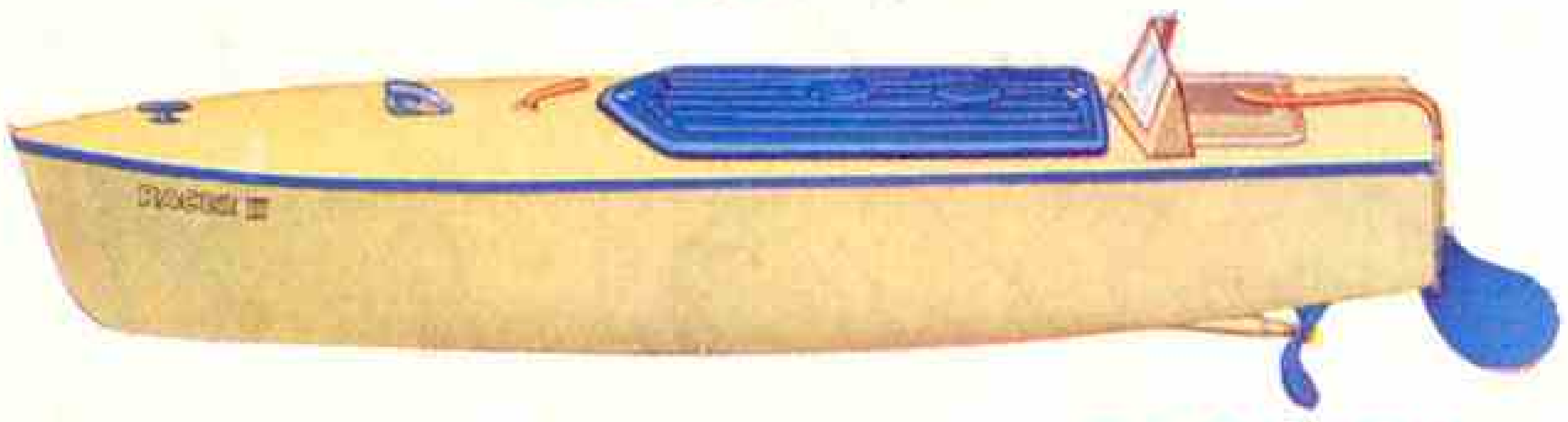

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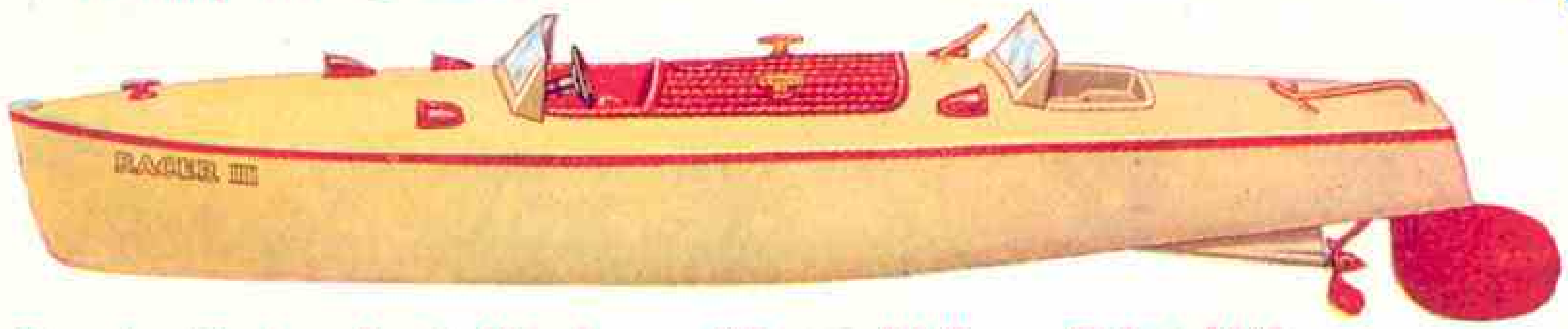

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